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Joseph Floy
1776

THE

ANATOMY

OF THE

HUMAN BONES, NERVES,

AND

LACTEAL SAC AND DUCT.

The NINTH EDITION.

1st & the Nerves

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EDINBUR

BRITISH MUSEUM

TO THE

STUDENTS of ANATOMY,

IN THE

Univerſity of EDINBURGH.

GENTLEMEN,

WHEN this *Oſteology* was firſt printed in 1726, I did not know that Albinus, Winſlow, and Palfyn, were to publiſh deſcriptions of the bones; otherwiſe my papers probably would have remained yet undelivered to the printers. I however flatter myſelf, that this *eſſay* has been of uſe to the gentlemen who did me the honour to attend my lectures, by aſſiſting them to underſtand my ſenſe and repreſentation of things in this fundamental part of anatomy; and that it has poſſibly been of more advantage to them than a more compleat work from an abler hand, unleſs my demonſtrations had been in the order and method of ſuch an author.

This view of your improvement, Gentlemen, is a prevailing argument with me to cauſe this eſſay to be reprinted; and you cannot reaſonably blame me, if I likewiſe acknowledge another motive for it, which more particularly relates to myſelf. In a new edition an author has an opportunity of making his works more correct, compleat, and conſequently acceptable to the public, who may perhaps be indulgent enough to think this little treatiſe not altogether uſeleſs; ſince more reaſoning on the ſtructure and morbid *phænemona* of bones is to be found in it, than in the other writers, who have confined themſelves almoſt entirely to the deſcriptive or proper anatomical part of the *oſteology*.

I have here kept to the plan of the former editions, by firſt conſidering, in the order that ſeemed to me moſt natural and methodical, every thing which I thought neceſſary to be known concerning bones in general; and, in the ſecond part, I have deſcribed the ſeveral bones compoſing the ſkeleton.

nus, and Mr Sue (*a*), have publiſhed ſuch elegant ones.

You have advantageous opportunities in this place of ſtudying all parts of medicine, under the profeſſors of its different branches in the Univerſity, and of ſeeing the practice of pharmacy, ſurgery, and phyſic, with our ſurgeon-apothecaries, and in the Royal Infirmary, where the diſeaſed poor are carefully treated. Theſe your intereſt, and, I hope, your inclinations, will lead you, Gentlemen, ſo to improve, as that they may become the happy means of your making a conſiderable figure in your ſeveral ſtations. Whatever aſſiſtance is in my power towards ſuch a deſirable event, ſhall be given with the greateſt pleaſure by

Your humble ſervant,

ALEX^{R}. MONRO.

(*a*) Traitè d'oſteologie, traduit de l'Anglois de M. MONRO, ſeconde partie.

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THE ANATOMY OF THE HUMAN BONES.

PART I.

Of the BONES in general.

BONES are covered by a membrane, named on that account PERIOSTEUM *, which is ſo neceſſary to them, that we muſt examine its texture and uſes, before we can underſtand their ſtructure.

The *perioſteum*, as well as moſt other membranes, can be divided into *layers* of fibres. The *exterior* ones, compoſed of the fibres of the muſcles connected to the bones, vary in their number, ſize, and direction, and conſequently occaſion a very great difference in the thickneſs and ſtrength of the *perioſteum* of different bones, and even of the different parts of the ſame bone. The *internal* layer is every

where

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* Membrana circumoſſalis, omentum oſſibus impoſitum.

where nearly of a ſimilar ſtructure, and has its fibres in the ſame direction with thoſe of the bone to which they are contiguous Ought not then the name *perioſteum* to be applied, ſtrictly ſpeaking, only to this internal layer, to which the others are joined in an uncertain manner and number?

Some authors (a) endeavour to prove the internal layer of fibres of the *perioſteum* to be derived from the *dura mater*: For, ſay they, ſince the membrane covering the ſcull is plainly a production or continuation of the *dura mater*, which paſſes out between the ſutures; and ſince there are muſcles on the head, as well as in other parts, which might furniſh a *perioſteum*, it is needleſs to aſſign different origins to membranes which have the ſame texture and uſes. They add further, in proof of this doctrine, that the *perioſteum* extends itſelf along the ligaments of the articulations from one bone to another; and therefore is continued from its origin over all the bones of the body.—While anatomiſts were fond of the hypotheſis of all membranes being derived from one or other of the two that cover the brain, a diſpute of this kind might be thought of conſequence: But now that the hypotheſis is neglected as uſeleſs, it is needleſs to examine the arguments for or againſt it.

Except where muſcles, cartilages, or ligaments are inſerted into the *perioſteum*, its external ſurface is connected to the ſurrounding parts by thin cellular membranes, which can eaſily be ſtretched conſiderably, but ſhorten themſelves whenever the ſtretching force is removed.

(a) Havers, Oſteolog. nov. diſc. 1. p. 16.

moved. When theſe membranes are cut off or broken, they collapſe into ſuch a ſmall ſpace, that the ſurface of the *perioſteum* ſeems ſmooth and equal.

When we attempt to tear off the *perioſteum* from bones, we ſee a great number of white threads produced from the membrane into them; and, after a ſucceſsful injection of the arteries with a red liquor, numerous veſſels are not only ſeen on the *perioſteum* (*a*), but moſt of the fibres ſent from the membrane to the bone, ſhew themſelves to be veſſels entering it, with the injected liquor in them; and when they are broken, by tearing off the *perioſteum*, the ſurface of the bone is almoſt covered with red points.

The veins correſponding to theſe arteries are ſometimes to be ſeen in ſubjects that die with their veſſels full of blood; though ſuch numerous ramifications of them, as of the arteries, can ſeldom be demonſtrated, becauſe few of them naturally contain coloured liquors, and ſuch liquors can difficultly be injected into them. This however is ſometimes done (*b*).

The great ſenſibility of the *perioſteum* in the deep-ſeated ſpecies of *paronychia*, in *exoſtoſes*, *nodi*, *tophi*, and *gummata*, from a *lues venerea*, or whenever this membrane is in an inflamed ſtate, is a ſufficient proof that it is well provided with nerves, though they are perhaps too ſmall to be traced upon it; and therefore one

cannot

(*a*) Ruyſch. Epiſt. 5. tab. 5. fig. 1. 2. epiſt. 8. tab. 9. fig. 1 9

(*b*) Sue traité d'oſteologie, traduit de l'Anglois de Mr Monro. Note in page 9.

cannot well determine, whether they are ſent along with the arteries in the common way, or are derived from the tendinous fibres of the muſcles expanded on the *perioſteum* (*a*).

Veſſels alſo paſs through the *perioſteum* to the marrow; of which more hereafter. And frequently muſcles, ligaments, or cartilages, pierce through the *perioſteum*, to be inſerted into the bones.

The chief uſes of the *perioſteum* are: 1. To allow the muſcles, when they contract or are ſtretched, to move and ſlide eaſily upon the bones; the ſmooth ſurface of this membrane preventing any ill effects of their friction upon each other. 2. To keep in due order, and to ſupport the veſſels in their paſſage to the bones. 3. By being firmly braced on the bones, to aſſiſt in ſetting limits to their increaſe, and to check their overgrowth. 4. To ſtrengthen the conjunction of the bones with their *epiphyſes*, ligaments, and cartilages, which are eaſily ſeparated in young creatures, when this membrane is taken away. 5. To afford convenient origin and inſertion to ſeveral muſcles which are fixed to this membrane. And, laſtly, to warn us when any injury is offered to the parts it covers; which, being inſenſible, might otherwiſe be deſtroyed without our knowledge, or endeavouring to procure a remedy.

When

(*a*) See the diſpute about the ſenſibility of this and of other membranes in Zimmerman. Diſſert. de irritabilit.—— Act. Gotting vol. 2 ---- Haller Sur la nature ſenſible et irritable.—Whytt's phyſiolog. eſſay II.—Remar. Diſſert. de fungo articulor. § 26. 34.

When the cellular ſubſtance connecting the *perioſteum* to the ſurrounding parts is deſtroyed, theſe parts are fixed to that membrane, and loſe the ſliding motion they had upon it; as we ſee daily in iſſues, or any other tedious ſuppurations near a bone.—When the veſſels which go from the *perioſteum* to the bones are broken or eroded, a collection of liquor is made between them, which produces a ſordid ulcer or rotten bone. This often is the caſe after fractures of bones, and inflammations of the *perioſteum*, or after *ſmall-pox*, *meaſles*, *ſpotted fevers*, and *eryſipelas*.—Do not the diſorders of the *perioſteum*, coming rather along with or ſoon after the cutaneous than other diſeaſes, indicate ſome ſimilarity of ſtructure in the *perioſteum* and ſkin?

The BONES are the moſt hard and ſolid parts of the body, and, as all other parts where large veſſels do not enter, are generally of a white colour; only in a living creature they are blueiſh, which is owing to the blood in the ſmall veſſels under their ſurface. The leſs therefore and fewer the veſſels are, and the thicker and firmer the bony ſurface covering the veſſels is, the bones are whiter. Hence the bones of adults are whiter than thoſe of children; and, in both young and old, the white colour of different bones, or of the ſeveral parts of the ſame bone, is always in proportion to their veſſels and ſolidities; which circumſtances ought to be regarded by ſurgeons, when they are to judge of the condition of bones laid bare.

Bones are compoſed of a great many *plates* *, each of which is made up of fibres or ſtrings united by ſmaller fibrils (*a*); which being irregularly diſpoſed, and interwoven with the other larger fibres, make a reticular work. —— This texture is plainly ſeen in the bones of fœtuſes, which have not their parts cloſely compacted, and in the bones of adults which have been burnt, long expoſed to the weather, or whoſe compoſition has been made looſe by diſeaſes.—The chinks which are generally made according to the direction of the larger fibres of bones that have undergone the action of fire, or of the weather, ſhew the greater ſtrength of theſe than of the fibres which connect them.—Numerous accurate obſervations of the different times in which exfoliations are made from the ſides or ends of ſimilar bones, might bid fair to determine what is the proportional force of coheſion in the two ſorts of fibres.

The plates are ſaid (*b*) to be firmly joined to each other by a great number of *claviculi*, or ſmall bony proceſſes, which, riſing from the inner plates, pierce through ſome, and are fixed into the more external ones. Of theſe nails, four kinds, *viz. the perpendicular*, *oblique*, *headed*, and *crooked*, have been deſcribed: But in bones fitly prepared, I could only ſee numerous irregular proceſſes riſing out from the plates (*c*).

Though the exterior part of bones is compoſed of firm compact plates, yet they are all more or leſs cavernous internally. In ſome (*e. g.* middle thin part of the *ſcapula* and *os ilium*) the ſolid ſides are brought ſo near, that little cavity can be ſeen; and in others (middle of *os humeri*, *femoris*, &c.) the cavities are ſo large, that ſuch bones are generally eſteemed to be hollow or fiſtular. But the internal ſpongy texture is evident in young animals; and ſome of it may be ſeen to remain in thoſe of greateſt age, when bones are cautiouſly opened, after they have been kept ſo long as to be free of the oil they contain, or after being burnt.

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* Squamæ, bracteæ, laminæ.

(*a*) Malpigh. Anat. plant. & oper. poſthum.

(*b*) Gagliard. Anat. oſſium. nov. invent. illuſtrat. cap. 1. obſ. 2.

(*c*) Malpigh. oper. poſthum.

This ſpongy cavernous internal part of bones, is generally called their *cancelli* or LATTICE-WORK, and is formed in the following manner. The plates are firmly joined about the middle of the bone; but as they are extended towards its ends, the more internal plates ſeparate from the exterior, and ſtretch out their fibres towards the axis of the bone, where they are interwoven with the fibres of other plates that have been ſent off in the ſame way. Seeing the plates are thus conſtantly going off, the ſolid ſides of the bones muſt become thinner, and the lattice-work muſt be thicker and ſtronger towards their ends. This is evident in many of them, where the ſolid ſides of their middle are very thick, and the *cancelli* are ſcarce obſervable; whereas, at the ends, where their diameter is greateſt, the ſolid walls or ſides are not thicker than paper, and the *cancelli* are numerous and large enough to fill up the whole ſpace left between the ſides.

The twiſting and windings which theſe *cancelli* make, and the interſtices which they leave, differ conſiderably in figure, number, and ſize; and therefore form little cells, which are as different, but communicate with each other. Some writers (*a*) minutely remark theſe different appearances of the *cancelli*, after they begin to ſeparate from the plates; and from thence diſtinguiſh them into *wrinkled*, *perforated*, and *net-like*.

The *cancelli* ſuſtain the membranous bags of the marrow which are ſtretched upon them, and thereby hinder theſe membranous parts to be torn or removed out of their proper places, in the violent motions and different poſtures which the bones are employed in. This Support which the *cancelli* afford the marrow, alſo ſaves its membranes and veſſels, in the lower parts of the bones, from being compreſſed by the weight of the marrow above.

The depreſſions between the fibres of the external plates of bones appear like ſo many furrows on their ſurface, into each of which the *perioſteum* enters; by which the ſurface of contact, conſequently the coheſion, between it and the bone, is conſiderably increaſed, and a greater number of veſſels is ſent from it into the bone, than if it was a plain ſurface.

Both on the ridges and furrows, numerous little pits or orifices of canals are to be ſeen, by which the veſſels paſs to and from the bones.

After a ſucceſsful injection, the arteries can be traced in their courſe from the pits to the plates and fibres; and, in ſawing, cutting, or raſping the bones of living creatures, theſe veſſels diſcover themſelves, by the ſmall drops of blood

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(*a*) Gagliard. Anat. oſſium, cap. 1. obſ. 4. 5. 6. 7.

ood which then ouze out from the moſt ſolid
rt of the bones. But the cleareſt demonſtra-
on of the intimate diſtribution of theſe ſmall
teries, is, to obſerve the effect of ſuch a tin-
ng ſubſtance as can retain its colour, when
vallowed, digeſted, and mixed with the blood
f any living animal, and at the ſame time has
articles ſmall enough to be conveyed into the
eſſels of the bones; ſuch is *rubia tinctorum*,
adder-root (*a*): For we ſee the gradual ad-
ances which this tincture makes from the *pe-*
oſteum into the more internal parts of the
ones, and how univerſally the diſtribution of
e liquors is made, the whole bony ſubſtance
eing tinged. Whether the time in which this
nged liquor paſſes from the outer to the in-
ernal plates, till all the plates are made of its
olour, and the time which the diſappearing
f the dye, after giving the creature no more
f this ſort of food, makes us think it takes
o return, are the ſame in which the natural li-
uors circulate, is uncertain; becauſe this tin-
ing ſubſtance may move more ſlowly, or may
aſs more quickly, than the natural liquors do.
——The arteries are larger near each end than
t the middle of the large bones that are much
oved; becauſe they not only ſerve the bony
lates near the ends, but paſs through them to
e marrow.——As animals advance in age, the
teries of the bones become leſs capacious; as
evident, 1. From the bones of adults having
eſs blood in them than thoſe of children have.
2. From

(*a*) Philoſoph. tranſact. num. 442, art. 8. num. 443.
t. 2. num. 457. art. 4.——Mem. de l'acad. des ſciences.
739, 1742.

2. From many of them becoming incapable in old age of admitting the coloured powders uſed in injections, which eaſily paſs in youth. And, 3. From the bones of old creatures being more difficultly tinged with madder than thoſe of young ones.—If authors have not miſtaken, the arteries of bones have ſometimes become very large (*a*).

We may conclude from arteries being accompanied with veins ſo far as we can trace them in every other part of the body, that there are alſo veins in the bones; and the diſappearing of the tincture of *madder*, after bones of living animals are coloured with it, could not be without ſuch veins to carry it away; nay, the veins of bones can ſometimes be injected and then ſeen (*b*).

The bones of a living animal are ſo inſenſible, that they can be cut, raſped, or burnt, without putting the creature to pain, and the nerves diſtributed in their ſubſtance cannot be ſhewn by diſſection; from which it might be inferred that they have no nerves diſtributed to them: But the general tenor of nature, which beſtows nerves to all the other parts, ſhould prevent our drawing ſuch a concluſion. And if ſenſibility is a ſure proof of nerves entering into the compoſition of any part, as it is generally allowed to be, we have ſufficient evidence of nerves here in the bones; for the granulated red fleſh which ſprouts out from them, after an amputation of a limb, or performing the operation

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(*a*) Diemerbroeck. Anat. lib. 9. cap. 1. —— Mery. Hiſt. de l'acad. des ſciences, 1704.

(*b*) Sue trad. d'oſteolog, p. 9.

eration of the *trepan*, or after an *exfolia*-*ion*, is exquiſitely ſenſible : And, in ſome ul-ers of bones, where the *perioſteum* was all ſe-arated, the patient ſuffered racking pain, if he bone was touched with a rough inſtrument; or was he free of pain after the bone was per-orated (*a*)——The reaſon why the nerves of igid hard bones become inſenſible, is, That all erves muſt have a conſiderable degree of lexibility at the part where objects are applied, therwiſe it cannot be affected by their impreſ-ions. We ſee this illuſtrated in a very common nalogous caſe, the growth of a new nail: When the former one has ſuppurated off, the hin membrane which firſt appears, is exquiſite-y ſenſible; but gradually becomes dull in its enſation, till it can be cut or ſcraped, without cauſing pain, after it is formed into a hard nail.

From what has been ſaid of the veſſels of bones, it is evident, that there is a conſtant circulation of fluids in every part of them; and that there is a perpetual waſte and renewal of the particles which compoſe the ſolid fibres of bones, as well as of other parts of the body; the addition from the fluids exceeding the waſte during the growth of the bones; the renewal and waſte keeping pretty near *par* in adult middle age; and the waſte exceeding the ſupply from the liquors in old age; as is demonſtrable from their weight: For each bone increaſes in weight, as a perſon approaches to maturity; continues of nearly the ſame weight till old age begins, and then becomes lighter. ——The ſpecific gravity of the ſolid ſides, on the

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(*a*) Nicol. Maſſa, lib. introd. anat. cap. 30.

the contrary, increaſes by age; for then they become more hard, compact, and denſe. In conſequence of this, the bones of old people are thinner and firmer in their ſides, and have larger cavities than thoſe of young perſons.

The vaſcular texture of bones muſt make them ſubject to *obſtructions*, *ecchymoſes*, *ulcers*, *gangrenes*, and moſt other diſeaſes which the ſofter parts are affected with; and therefore there may be a greater variety of *caries* than is commonly deſcribed (*a*).

Hence we can account for the following appearances.

Hæmorrhagies from fungous fleſh riſing out from the moſt ſolid part of a cut bone (*b*).

The regular alternate elevation and ſubſiding, or apparent pulſation, frequently to be ſeen in ſome of the cells of a carious bone.

Cells reſembling *cancelli*, ſometimes ſeen in the part of a bone, which, in a natural ſtate, is the moſt ſolid and firm (*c*).

A bone as a tube including another bone within it (*d*).

On the internal ſurface of the ſolid parts of bones, there are orifices of canals, which paſs outwards through the plates to open into other canals that are in a longitudinal direction, from which other *tranverſe* paſſages go out to terminate in other *longitudinal* canals; and this ſtructure is continued through the whole ſubſtance of bones, both theſe kinds of canals becoming ſmaller

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(*a*) Edinburgh Medical eſſays and obſ. vol. 5. art 25.

(*b*) Medical eſſays, vol. 4. art. 21.

(*c*) Ruyſch. Theſ. 8, num. 8. Theſ. 10. num. 176.

(*d*) Idem, ibid.

ſmaller gradually as they approach the outer ſurface (*a*).—Theſe canals are to be ſeen to the beſt advantage in a bone burnt till it is white: When it is broken tranſverſely, the orifices of the *longitudinal* canals are in view; and when we ſeparate the plates, the *tranſverſe* ones are to be obſerved. Here however we are in danger of believing both theſe ſorts of canals more numerous than they really are; becauſes the holes made by the proceſſes connecting the plates of bones have the appearance of the *tranſverſe* (*b*), and the paſſages for the blood-veſſels reſemble the *longitudinal* canals. I don't know how we are to keep free of error about the *tranſverſe* canals; but think we may diſtinguiſh between the two kinds of *longitudinal* ones; for the paſſages of the veſſels are largeſt near the external ſurface of the bone, and every tranſverſe ſection of them is circular; whereas the *longitudinal canals* are largeſt near the *cancelli*, and their tranverſe ſections appear to me of a flat oval figure, which may be owing to the different *momentum* of the fluids conveyed in them.—The ſituation of the larger longitudinal canals, and of the paſſages of the larger veſſels, makes a bone appear more denſe and compact in the middle of its ſolid ſides, than towards its outer and inner ſurfaces, where it is ſpongy.

We ſee marrow contained in the larger tranſverſe and longitudinal canals juſt now deſcribed, and from thence judge that it paſſes

alſo

(*a*) H avers Oſteolog. nov. p. 43.
(*b*) Morgagn. Adverſ. 2. animad. 25.

alſo into the ſmaller ones. The drops of oil which we diſcover with a microſcope every where on the ſurface of a recent bone fractured tranſverſely, and the ouſing of oil through the moſt ſolid bones of a ſkeleton, which renders them greaſy and yellow, are a confirmation of the uſe of theſe canals. Of what advantage this diſtribution of the marrow thro' the ſubſtance of bones is, will be mentioned when the nature and uſe of this animal oil is inquired into.

Moſt bones have one or more large oblique canals formed through their ſides for the paſſage of the medullary veſſels, which are to be deſcribed afterwards.

Bones expoſed to a ſtrong fire in chemical veſſels, are reſolved, in the ſame manner as the other parts of animals, into *phlegm*, *ſpirit*, *volatile ſalt*, *fetid oil*, and a black *caput mortuum*. But the proportion of theſe principles varies according to the age, ſolidities, and other circumſtances of bones. Young bones yield the largeſt proportion of *phlegm*; ſpongy bones afford moſt *oil*, and ſolid ones give moſt ſalt and black *reſiduum*.—Though this *reſiduum* can ſcarce be changed by the force of fire while it is in cloſe veſſels; yet, when it is burnt in an open fire, the tenacious oil, to which it owes its black colour, is forced away, and a white earth is left that has little or no fixed ſalt in it. This earth ſeems to be the proper conſtituent ſolid part of bones, and the other principles give it firmneſs and tenacity: For the quantity of the earth is ſo great, that, after all the other principles are ſeparated from a bone, its former ſhape and ſize remain (*a*); but it is very brittle till it is moiſtened with water or oil, when it recovers ſome tenacity.—The increaſe of the proportion of earth in old people's bones is one reaſon of their being more brittle than thoſe of young people are.

Leſt any imagine the ſalts and oils of bones, while in a natural ſtate, to be of the ſame acrid kind with thoſe obtained from them by the chemical analyſis, it is to be obſerved, that theſe principles may be extracted from bones in the form of a very mild jelly, by boiling them in water.

The bones ſuſtain and defend the other parts of the body.

Bones are lined within, as well as covered externally, with a membrane; which is therefore commonly called PERIOSTEUM INTERNUM.

The *internal perioſteum* is an extremely fine membrane; nay frequently it has a looſe reticular texture; and therefore it is compared by ſome to the *arachnoid* coat of the ſpinal marrow: ſo that we cannot expect to divide it into layers as we can divide the *external perioſteum*. We can however obſerve its proceſſes entering into the tranſverſe pores of the bones, where probably they are continued to form the immediate canals for the marrow diſtributed through the ſubſtance of the bones; and along with them veſſels are ſent, as from the external *perioſteum*, into the bone (*b*). Theſe proceſſes being of a very delicate texture, the adheſion of

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(*a*) Havers Oſteolog. nov. diſc. 1. p. 32

(*b*) Winſlow Expoſition anat. des os frais, § 82. 83.

of this membrane to the bone is ſo ſmall, that it ſeparates commonly more eaſily from the bone than from the marrow which it contains: Wherefore, one might call it the common membrane of the marrow, rather than by the name it now has. But whether one or t'other deſignation ought to be given it, is not worthy a diſpute.

From the internal ſurface of the internal *perioſteum*, a great number of thin membranes are produced; which, paſſing a-croſs the cavity, unite with others of the ſame kind, and form ſo many diſtinct bags, which communicate with each other; and theſe again are ſubdivided into communicating veſicular cells, in which the marrow is contained. Hence it is, that the marrow, when hardened, and viewed with a microſcope, appears like a cluſter of ſmall pearl; and that the hardened marrow of bones buried long under ground, or laid ſome time in water, and then dried, is granulous (*a*). This texture is much the ſame with what obtains in the other cellular parts of the body, where fat is collected; only that the cells containing the marrow are ſmaller than thoſe of the *tunica adipoſa* or *celluloſa* elſewhere, which probably is owing to their being incloſed in the bones, where they are not ſo much ſtretched or extended as in other parts.

The MARROW is the oily part of the blood, ſeparated by ſmall arteries, and depoſitated in theſe cells. Its colour and conſiſtence may therefore

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(*a*) Ruyſch. Theſaur. 9. num. 2. et Adverſ. dec. III. obſ. 9.

therefore vary according to the ſtate of the veſſels, and their diſtribution on the membranes of the cells.

The marrow as well as the other fat of the body chemically analized yields, beſides oil and water, a conſiderable proportion of an acid liquor, but no *alcali* (*a*). This may be the reaſon of its being leſs putreſcent than the blood or moſt other parts of animals (*b*), which is a neceſſary quality in a ſubſtance that is conſtantly expoſed to a conſiderable degree of heat, and is more in a ſtagnating condition than the other liquors.

Beſides the arteries, which I mentioned already, *p.* 9. to be ſent from the bones to the marrow, there is at leaſt one artery for each bone; ſeveral bones have more, whoſe principal uſe is to convey and ſecern this oily matter. After theſe arteries have pierced the ſolid ſide of a bone, they are divided into ſeveral branches; which ſoon are diſtributed every where on the internal *perioſteum*, and afterwards ſpread their branches inwards on the medullary cells, and outwards through the tables of the bone.

The blood, which remains after the ſecretion of the marrow, is returned by proper veins, which are collected from the membranes into one or two large trunks, to paſs out at the ſame holes or paſſages at which the artery or arteries enter.

The

(*a*) Grutzmaker Diſſert. de oſſium medulla.—Haller Element. phyſiolog. lib. 4. ſect. 4.

(*b*) Pringle Append. to camp diſeaſes, exper. 47.

The general rule of the ſmall veſſels decreaſing in their capacities as animals advance in age, to which many phaenomena in the animal oeconomy are owing, obtains here: For tho' the trunks of the medullary veſſels enlarge as animals turn older; yet the ſmall branches become ſmaller; as is evident from injections, which cannot be made to paſs near ſo far in theſe veſſels of adults as of children. Hence the marrow is bloody in children, oily and balmy in middle age, and thin and watery in old people.

By experiments made on the marrow, when bones of living animals are opened or cut thro' (*a*), and from the racking pain with which ſuppurations within bones are frequently attended, we have ſufficient proof that the membranes here are ſenſible, and conſequently have nerves diſtributed to them. *Hippocrates* (*b*) might therefore ſay juſtly, that a wound penetrating into the cavity of a bone may produce a *delirium*.

The veſſels of the marrow, wrapt up in one common coat from the *perioſteum*, paſs thro' the bones by proper canals; the moſt conſiderable of which are about the middle of each bone, and are very oblique. Sometimes theſe veſſels continue at a little diſtance in their paſſage when the canal is divided by a ſmall bony partition or two.

From the ſtructure of the contents of the bones, we may judge how theſe parts, as well as

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(*a*) Du Verney, Memoires de l'acad. des ſciences, 1700.
(*b*) Aphoriſm. § 7. aph 24.

s others, may be ſubject to oidema, phleg-
non, eryſipelas, ſchirrhus, &c. and may thence
e led to a cure of each, before the common
onſequence, putrefaction, takes place, and
requently occaſions the loſs of the limb, if
ot of the patient.

The marrow is of very conſiderable uſe to
he bones; for by entering their tranſverſe
anals, and paſſing from them into the longi-
udinal ones, it is communicated to all the
lates, to ſoften and connect their fibres,
vhereby they are preſerved from becoming too
rittle; as we ſee they do in burnt bones, or
hoſe long expoſed to the air; in people la-
ouring under old age, pox, or ſcurvy: In all
vhich caſes, the oil is either in too little quan-
ity, or has its natural good qualities changed
or worſe ones.

Beſides this advantage which the ſubſtance
f bones has from the marrow, their articu-
ations are ſaid (a) to receive no leſs benefit
rom it: for it is thought that the marrow
aſſes into the articular cavities, through the
oles which are in the bones near the large
oints. And, as a proof of this, it is alledged,
hat butchers, upon ſeeing the greater or leſ-
er quantity of marrow, in the bones of cows,
can tell whether they have travelled far or lit-
tle before they were ſlaughtered.

When the marrow, after having ſerved the
uſes mentioned, is reaſſumed into the maſs of
blood, (as it is continually, in common with
all other ſecreted liquors that have not paſſa-
ges

(a) Joan de Muralto Vade mecum anat. exercit. 5. § 3. Havers Oſteolog. nov. diſc. 3. p. 179.

ges formed for conveying them out of the body), it correcťs the too great acrimony communicated to the ſaline particles of our fluids by their circulation and heat; in the ſame manner as lixivial ſalts are blunted by oil in making ſoap. Hence, in acute diſeaſes, the marrow, as well as the other fat of the body, is quickly waſted, but muſt be immediately ſupplied by liquors from the veſſels; ſeeing the cells within the bones, which have no aſſiſtance to their contraction from the preſſure of the atmoſphere, cannot collapſe, as the *tela cellularis* under the ſkin does, when the liquor in its cells is abſorbed; the bones therefore are always full.

Since it is the nature of all oil to become thin and rancid when expoſed long to heat, and bones have much oil in their firm hard ſubſtance, we may know why an ungrateful ſmell, and dark coloured thin *ichor*, proceed more from corrupted bones than from other parts of the body; and we can underſtand the reaſon of the changes of colour which bones undergo, according to their different degrees of mortification.—Hence likewiſe we may learn the cauſe of a *ſpina ventoſa*, and of the difficulty of curing all *caries* of bones proceeding from an obſtruction, and conſequent putrefaction of the marrow; and of the quick pulſe, thirſt, and *hectic paroxyſms*, ſo often attending theſe diſeaſes. Theſe *phaenomena* alſo teach us the reaſon of the fatal *prognoſis* taken from black fetid urine in fevers.

Though bones ſo far agree in their ſtructure and annexed parts, yet we may obſerve a conſiderable

ſiderable difference among them in their magitude, figure, ſituation, ſubſtance, connection, ſes, *&c.* From which authors have taken ccaſion to diſtinguiſh them into as many laſſes as they could enumerate of theſe differnt circumſtances. But theſe being obvious o every perſon that looks on bones, I ſhall nly mention one of them; which compreends very near the whole bones of the body, nd at the ſame time leads us to examine the oſt conſiderable variety that is to be found n the diſpoſition of their conſtituent parts, nd in their uſes. It is this, that ſome bones re *broad* and *flat*, while others are *long* and *ound*.

The *broad* bones have thin ſides, by the lates being ſoon and equally ſent off to form he lattice-work; which therefore is thicker, nd nearly of an equal form all through. By his ſtructure, they are well adapted to their ſes, of affording a large enough ſurface for he muſcles to riſe from, and move upon, and f defending ſufficiently the parts which they ncloſe.

The *round* bones have thick ſtrong walls in he middle, and become very thin towards their nds, which is owing to very few plates ſepaating at their middle; where, on that account, he *cancelli* are ſo fine and ſmall. that they are ot taken notice of: But ſuch bones are ſaid o have a large reſervoir of oil in this place. Towards their ends the lattice-work becomes ery thick, and rather more compleat than in he other ſort of bones.—Theſe round bones aving ſtrong forces naturally applied to them, and being otherwiſe expoſed to violent injuries, have need of a cylindrical figure to reſiſt external preſſure, and of a conſiderable quantity of oil to preſerve them from becoming too brittle. Beſides which, they are advantageouſly provided with thick ſides towards their middle, where the greateſt forces are applied to injure them; while their hollowneſs increaſes their diameter, and conſequently their ſtrength to reſiſt forces applied to break them tranſverſely (*a*). Thus, for inſtance, in eſtimating the proportional reſiſtence of two cylindrical bones of unequal diameters, but conſiſting of an equal number of ſimilar fibres uniformly diſpoſed round each, it is plain,

1. That the abſolute force of theſe two bones is equal, becauſe they conſiſt of equal numbers of ſimilar fibres.

2. That the abſolute forces of all the fibres in each bone have the ſame effect in reſiſting any power applied to break them, as if the ſum of all their forces was united in the reſpective centers of the tranſverſe ſections where the fractures are to be made. For, by hypotheſis, the fibres being uniformly diſpoſed in each, there is not any fibre in either bone that has not a correſponding fibre; the ſum of both whoſe diſtances from the axis of revolution (about which all the parts of the bone muſt revolve in breaking) is equal to two ſemidiameters of the bone: Conſequently each fibre, and all the fibres, may be regarded as reſiſting at the diſtance of one ſemidiameter or *radius* from this axis, that is, in the center.

3. Since

(*a*) Galilei Mechanic. dialog. 2.

3. Since the united force of all the fibres is
be regarded as reſiſting at a diſtance from
e center of motion equal to the ſemidiame-
r, it follows, that the total reſiſtence of all
eſe fibres, or the ſtrength of the bone, is
oportional to its ſemidiameter, and conſe-
uently to its diameter.

I have here taken for an example one of the
oſt ſimple caſes for calculating the proportio-
l forces of bones. But, was it not too fo-
ign to the preſent deſign, it might be univer-
lly demonſtrated, that, of whatever figure
ones are, and in whatever manner their fibres
e diſpoſed, their ſtrength muſt always be in a
tio, compounded of the area of their tranſ-
rſe ſections, or of their quantity of bony
atter, and of the diſtance of the center of
avity of theſe ſections from the center of
otion or fulcrum, on which the bone is ſup-
ſed to be broken (*a*).

Since therefore the ſtrength of bones de-
nds on their number of fibres, or quantity
matter, and the largeneſs of their diame-
rs, one may conclude, that the part of a bone
rmerly fractured, and reunited by a *callus*,
uſt be ſtronger than it was before the fracture
ppened; becauſe both theſe advantages are
tained by a *callus*; which is a wiſe proviſion,
ce bones are never ſet in ſuch a good dire-
ion as they were naturally of; and then
here-ever a *callus* is formed, there is ſuch an
ſtruction of the veſſels, that if the bone was
again

(*a*) See the demonſtration of this theorem by Dr Porter-
ld in the Edinburgh Medical eſſays, vol 1. art. 10.

again broken in the ſame place, the *oſſific* matter could not ſo eaſily be conveyed to re-unite it. This *callus* may indeed, for want of compreſſion, be allowed to form into a ſpongy cellular ſubſtance (*a*); but even in this caſe the ſtrength of the bone is here increaſed by one or both the cauſes above mentioned.

Many bones have protuberances, or *pro-ceſſes* *, riſing out from them. If a *proceſ* ſtands out in a roundiſh ball, it is called *caput*, or *head.*—If the head is flatted, it obtains the appellation of *condyle.*———A rough unequa protuberance, is called *tuberoſity.* -- When *proceſs* riſes narrow, and then becomes large the narrow or ſmall part is named *cervix*, o *neck.*———Long ridges of bones, are calle *ſpines.*———Such proceſſes as terminate in ſharp point, have the general name of *coronæ*†, or *coronoid*, beſtowed on them, though moſt o them receive particular names from the re ſemblance they have, or are imagined to have to other ſubſtances, *e. g. maſtoid, ſtyloid, an choroid, coracoid, ſpinal, &c.* ——Such proceſſe as form brims of cavities, are called *ſuperci lia* ‡.

Proceſſes ſerve for the advantageous origi and inſertion of muſcles, and render the arti culations firm and ſtable.

Befor

(*a*) Ruyſch. Theſaur. 8. n. 49. Muſ. anat. thec. B. repo ſit, 2. n. 2.

* Ἀπόφυσεις, ἔκφυσεις, ἐξοχὴ, πρόβολὴ, πρόβλημα, Exceſſus, explanatio, tuberculum, gibbus, eminentia, productio, extub rantia, projectura, enaſcentia.

† Roſtra, glandes.

‡ Ἴτυες, ὄφρυες, ἄμβωνες, χείλη, Labra.

Before leaving this ſubject, we muſt remark, that much the greater number of what are called proceſſes in adult bones, diſcover themſelves in children to be *epiphyſes*, or diſtinct bones, which are afterwards united to the other parts; ſuch are the *ſtyloid* proceſſes of the temporal bones, proceſſes of the *vertebræ*, *trochanters* of the thigh, *&c.* However, as I deſign to inſiſt chiefly on the deſcription of the adult ſkeleton, in which the union of theſe parts is ſo intimate, that ſcarce any veſtige remains of their former ſeparation, I ſhall retain the common appellation of *apophyſe*, or proceſs, to all ſuch protuberances; but ſhall remark the principal ones that have no juſt title to this name, when they occur in the deſcription of particular bones.

On the ſurfaces of a great many of the bones there are cavities, or depreſſions: If theſe are deep, with large brims, authors name them *cotylæ* *.——If they are ſuperficial, they obtain the deſignation of *glenæ*, or *glenoid.* Theſe general *claſſes* are again divided into ſeveral *ſpecies*:—Of which *pits* are ſmall roundiſh channels ſunk perpendicularly into the bone.—*Furrows* are long narrow canals, formed in the ſurface;——*nitches* or *notches*, ſmall breaches in the bone;—*ſinuoſities*, broad, but ſuperficial depreſſions without brims;——*foſſæ*, large deep cavities, which are not equally ſurrounded by high brims;—*ſinuſes*, large cavities within the ſubſtance of the bones, with ſmall apertures; ——*foramina*, or holes, canals that pierce quite through the ſubſtance of the bones.——When

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* Κοτυλὶδες, ὀξυβάφοι, Acetabula, pixides, buccellæ.

this laſt ſort of cavity is extended any long way within a bone, the middle part retains the name of *canal*, and its ends are called *holes*.

The cavities allow the heads of bones to play in them; they lodge and defend other parts; they afford ſafe paſſage to veſſels, muſcles, *&c.* To mention more would engage us too much in the hiſtory of particular bones, which more properly belongs to the demonſtration of the *ſkeleton*, where we ſhall have occaſion to obſerve theſe ſeveral ſpecies of cavities.

To far the greater number of bones, whoſe ends are not joined to other bones by an immoveable articulation, there are ſmaller ones annexed, which afterwards become ſcarce diſtinguiſhable from the ſubſtance of the bone itſelf. Theſe are called *epiphyſes*, or *appendices* *. Some bones have one, others have two, three, or four of theſe *appendices* annexed by the means of cartilages, which are of a conſiderable thickneſs in children, but by age become thinner; the oſſification proceeding from the end of the bone on one ſide, and from the *epiphyſes* on the other, till at laſt, in adults, the place of their conjunction can ſcarcely be ſeen on the external ſurface; and it is only ſometimes that we can then ſee any mark of diſtinction in the *cancelli* (*a*).

Several proceſſes (*e. g. trochanters* of the thigh, *ſpine* of the *ſcapula*, &c.) have *epiphyſes*; and proceſſes frequently riſe out from *epiphyſes*;

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* Applantatio, additamentum, adnaſcentia, adnexum, perone.

(*a*) Winſlow, Expoſition anatomique de corps humain, traité des os ſecs, § 116.

epiphyſes; for example, at the lower end of the *femur*, *ulna*, *tibia*, &c. (*a*).

The *epiphyſes* are united chiefly to ſuch bones as are deſtined for frequent and violent motion; and for this purpoſe they are wiſely framed of a larger diameter than the bone they belong to; for by this means, the ſurface of contact between the two bones of any articulation being increaſed, their conjunction becomes firmer, and the muſcles inſerted into them act with greater force, by reaſon of their axes being further removed from the center of motion. Theſe advantages might indeed have been obtained by the expanſion of the end of the bone itſelf, to a thickneſs equal to that of the *epiphyſes*; but then the conſtant ſeparation of new plates to form ſo wide a cellular ſtructure, muſt have left the ſolid ſides of the bones ſo thin, as to yield eaſily, either to the action of the muſcles fixed to them, and paſſing over them, to the weight ſeveral of them are obliged to ſupport, or to the application of any other external force.

Several anatomiſts (*b*) thought that the *epiphyſes* ſerve other purpoſes; ſuch as, ſecuring the ligaments of the articulations which riſe out from between the bones and them; for, as ſoon as theſe parts are intimately joined, the ligaments inſinuated betwixt them muſt have a much ſtronger connection than they could have to the ſmooth ſurface of the bones. Such an interception of the ligament between the body of

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(*a*) Veſal. De human. corp. fabrica, lib. 1, cap. 3.

(*b*) Collumb, De re anatomica, lib. 1, cap. 2. —— Fallop. Expoſ. de oſſibus, cap. 11.

of the bone and its *epiphyſe* is not to be ſeen; but as, at this place, the bone remains longer ſoft than any where elſe, and the adheſion of the *perioſteum*, and of ligaments to bones, is always ſtronger in proportion to the bones being neareſt to the conſiſtence of thoſe parts, which is, being ſofteſt, the opinion of theſe writers concerning the ſtronger connection of the ligaments, where the bones and *epiphyſes* join, is not without ſome foundation.

Poſſibly too, by the fibres of *epiphyſes* not extending themſelves ſo longitudinally as thoſe of the bones, there may be leſs chance of the former running into each other, than of the latter.

The ſoftneſs of the ends of bones may be of ſome advantage in the womb, and at birth, after which the oſſification begins at different points to form *epiphyſes*, before the oſſification can extend from the middle to the ends of the bones (*a*).

However ſolid and compact adult bones are, yet they were once cartilages, membranes, nay, a mere gelly. This needs no further proof, than repeated obſervations of *embryos* when diſſected: And how much more tender muſt the bones be before that time, when neither knife nor eye is capable to diſcover the leaſt rudiments of them? By degrees they become more ſolid, then aſſume the nature of griſtles, and at laſt oſſify; the coheſion of their plates and fibres always increaſing in proportion to their increaſed ſolidities; as is evident from the time neceſſary to unravel the texture of

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(*a*) Haller de ſtudio medic. p. 167.

of bones of people of different ages, or of denſe and of ſpongy bones, or of the different parts of the ſame bone, and from the more tedious exfoliations of the bones of adults than of children.

After any part of a bone is fully oſſified, its fibres are extended little more in length at that part, tho' they increaſe there in thickneſs, and tho' their ſofter parts continue to become longer (*a*).

As the ſolidity of bones increaſes, their *perioſteum* more eaſily ſeparates from them. When bones are membranous, the *perioſteum* and they cannot be diſtinguiſhed; they appear to be the ſame ſubſtance. When they are cartilages, their membrane adhere ſo firmly to them, that it is difficult to ſeparate it from them. Where the rigid bony fibres are, the *perioſteum* is eaſily taken off.—Is the ſimilarity of ſtructure and conſequent greater attraction of the membrane and ſubſtance it incloſes, while they are both flexible, the cauſe of their greater adheſion? or is it owing to the veſſels that go from the one to the other being then larger? or do both theſe cauſes combine to produce this effect? Or is the membrane or cartilage, which becomes bone afterwards, to be conſidered as the ſame ſubſtance with the *perioſteum* (*b*)? and muſt all theſe plates of bones be therefore ſaid to be layers of the *perioſteum* hardened (*c*)?

The

(*a*) Hales's Vegetable ſtatics, p. 293.——Du Hamel Memoires de l'acad. des ſciences, 1742.

(*b*) Memoires de l'acad des ſciences, 1744.

(*c*) Memoires de l'acad. des ſciences, 1743.

The oſſification of bones depends principally on their veſſels being ſo diſpoſed, and of ſuch diameters, as to ſeparate a liquor, which may eaſily turn into a bony ſubſtance, when it is deprived of its thinner parts; as ſeems plain from the obſervation of the callous matter ſeparated after fractures and ulcers, where part of the bone is taken out: For in theſe caſes, the veſſels extending themſelves, and the liquors added to them, are gradually formed into granulated fleſh; which fills up all the ſpace where the bone is taken from, then hardens, till it becomes as firm as any other part of the bone. This happens frequently, even when the ends of the diſeaſed bone are at a conſiderable diſtance from each other (*a*).

The induration of bones is alſo greatly aſſiſted by their being expoſed, more than any other parts, to the ſtrong preſſure of the great weights they ſupport, to the violent contraction of the muſcles fixed to them, and to the force of the parts they contain, which endeavour to make way for their own further growth. By all this preſſing force, the ſolid fibres and veſſels of bones are thruſt cloſer; and ſuch particles of the fluids conveyed in theſe veſſels as are fit to be united to the fibres, are ſooner and more firmly incorporated with them, while the remaining fluids are forcibly driven out by the veins, to be mixed with the maſs of blood. In conſequence of this, the veſſels gradually

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(*a*) Hildan. de vuln. graviſ. ——— Med eſſays, vol. 1. art. 23.—Job. a Meckren obſ. 69.—Mem. de l'acad. des ſciences, 1742.—See a collection of ſuch caſes in Boehmer de oſſium callo.

ally diminiſh as the bones harden. From
hich again we can underſtand one reaſon,
hy the bones of young animals ſooner reunite
fter a fracture than thoſe of old, and why
attle that are put too ſoon to hard labour, ſel-
om are of ſuch large ſize as others of the
me brood who are longer kept from labour.

That the oſſifying of bones greatly depends
n preſſure, ſeems to be evinced from the fre-
uent examples we meet with of other parts
urning bony, when long expoſed to the preſ-
ng force of the ſurrounding parts, or when
hey are ſubjected to the like circumſtances
y their own frequent and violent contrac-
ion. Witneſs, the bones found frequently near
he baſe of the heart in ſome old men (*a*), and
n ſeveral other creatures. Nay, the muſcular
ubſtance of the heart has been oſſified in ſuch
b), and the arteries of old men often become
ony.——The cartilages of the *larynx* are ge-
erally oſſified in adults.—In beaſts of burden,
he cartilages between the *vertebræ* of the
ack very often change into compleat bones;
nd, being intimately united with the *vertebræ*,
he whole appears one continued bone:—Nor is
he *perioſteum* exempted from ſuch an indura-
ion (*c*).

To confirm this argument ſtill farther, we may obſerve, that bones begin their oſſification

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(*a*) Riolan. Comment. de oſſib. cap. 32.—Bartholin. Hiſt. medic. cent. 1. hiſt. 50.——Ibid. cent. 2. hiſt. 45.

(*b*) Cheſelden, Anatomy, book 1. introd. —— Garengeot, Hiſt. de l'acad. des ſciences, 1726.

(*c*) Peyer. Ephemerid. German. decur. 2. ann. 7. obſerv. 205.

cation at the places where they are moſt expoſed to theſe cauſes, *viz.* in the cylindrical bones from a middle ring, and in the broad ones, at or near their center, from one or more diſtinct points. The reaſon of which is, That theſe parts are contiguous to the bellies of the muſcles annexed to the bones, where the ſwelling of theſe moving powers is greateſt. What the effects of this may be, let any judge, who view ſome of the bones, as the *ſcapula*, and *oſſa ilium*, which are covered with muſcles on each ſide; how compact and thin they are in adults, where the bellies of the muſcles were lodged; whereas in children they are thicker. But this being the middle part of theſe bones, where the greateſt number of fibres is, this particular place would have been much thicker in adults, had not this forcible cauſe been applied, which has not had ſuch effects in children, whoſe muſcles have not been much exercifed.—Beſides, if we allow that all the parts of a bone are equally increaſed by the conſtant ſupply of new particles, each fibre, and every particle of a fibre, endeavours to make way for its own growth, by puſhing the one next to it; and conſequently by far the greateſt preſſure is on the middle, to make the particles firm, and therefore to begin their oſſification there. Laſtly, the pulſation of the medullary arteries, which enter the bones near to this middle part, may, as authors have alledged, contribute perhaps ſomewhat to this induration.

From the effects of preſſure only it is, that we can account for the bones of old people having their ſides much thinner, yet more denſe and ſolid, while the cavities are much rger than in thoſe of young people; and for e prints of muſcles, veſſels, *&c.* being ſo uch more ſtrongly marked on the ſurfaces of e former than of the latter, if they belong to ople of near the ſame condition in life.— eſſure muſt likewiſe be the cauſe, which, in ople of equal ages, makes theſe prints ſtrong- in the bones of thoſe who had much labour nd exerciſe, than they are in people who have d an indolent unactive life.

Perhaps both the cauſes of oſſification a- ove mentioned, may be aſſiſted by the nature f the climate people live in, and the food ey uſe. Whence, in hot countries, the in- abitants ſooner come to their height of ſta- re than in the northerly cold regions: And ence ſeems to have ariſen the common prac- ce among the ladies, of making puppies drink randy or ſpirit of wine, and of bathing them n theſe liquors, to prevent their growing big. ay, it has been obſerved, that much uſe of ch ſpirits has occaſioned parts, naturally ſoft, o petrify in ſome, and to oſſify in other people f no great age (*a*).

From the foregoing account of the ſtructure f bones, and of their oſſification, we may nderſtand the reaſons of the following phaenomena.

How the natural colour of bones may be changed by ſome ſorts of food (*b*).

Why

(*a*) Littre, Hiſtoire de l'acad. des ſciences, 1706.—Geoffroy, Memoires de l'acad. des ſciences, 1706.

(*b*) Philoſoph. Tranſact. 442. art. 8. numb. 443 art. 2. numb. 457. art. 4. Mem. de l'acad. des ſciences, 1739, 1742.

Why the bones of ſome people are ſo long in hardening, and in others never compleatly indurate.

Why, in ſuch whoſe oſſification is ſlow, the bones are generally thicker in proportion to their lengths, eſpecially at their ends; as in the *rickets*.

How hard firm bones have become ſoft and pliable by diſeaſes (*a*).

Why in ſome diſeaſes, *epiphyſes* ſeparate from bones (*b*), and the ends of fractured bones come aſunder many years after their fractures appeared to be cured (*c*).

How bones may waſte and diminiſh (*d*).

How bones may become ſolid all through, without any appearance of *cancelli* (*e*).

How *nodes*, *tophi*, and *exoſtoſes*, happen after the eroſion of the external plates of bones in the *lues venerea*, *ſcurvy*, *rheumatiſm*, and *gout*.

How bones exfoliate by the riſing of granulated fleſh from their ſurface.

How and from what *callus* is formed after a fracture (*f*).

Why

(*a*) Hiſtoire de l'acad. des ſciences, 1700.—Mem. 1722—Gagliardi, Anatom. oſſium, cap. 2. obſerv. 3.—Ephem. Germ. decur. 1. ann. 1. obſ. 37. et ſchol. decur. 2. ann. 7. obſ. 212. 235. decur. 3. ann. 2. obſ. 3.——Philoſ. Tranſ. No. 470. § 3. Ibid. vol. 48. § 4. and 44.

(*b*) Memoires de l'acad. des ſciences, 1699.—Diemerbroek, Anat. lib. 9. cap. 19.—Cowper's Anat. explic. tab. 96. fig. 1.

(*c*) Anſon's Voyage.

(*d*) Cheſelden, Anat. book 1. introd.—Hiſt. de l'acad. des ſciences, 1700.

(*e*) Ruyſch. Theſaur. 2. arc. 5. theſ. 3. loc. 1. numb. 5. theſ. 9. numb. 2. not. 3.—Bochmer de callo oſſium.

(*f*) Memoires de l'acad. des ſciences, 1741.—Dehtleef de oſſium callo.

Why *callus* appears to be rather the conti-
ied ſubſtance of the *perioſteum* than of the
one, while it remains ſoft and flexible; but
ems continued with the bone after it oſſifies
).

Why *callus* is ſenſible, while it is ſoft, but
comes inſenſible when it hardens.

What occaſions ſometimes ſuch difficulty in
ring fractured bones; or why they never re-
ite, though they are reduced, and all proper
eans towards a cure are uſed (*b*).——Are the
nes of women with child more tedious in
uniting than thoſe of other people (*c*)?

Why *calluſes*, after fractures, are ſometimes
ry thick and protuberant.

What difference there ought to be in the
plication of bandages to fractures of the
nes of old and of young patients.

How bones, remaining long unreduced after
luxation, may have their form ſo changed
to make their reduction very difficult, if not
poſſible (*d*).

Whoever is deſirous to know, in what time
d order each bone and its ſeveral parts be-
n to aſſume a bony nature, let him conſult
Kerkringius

(*a*) Mem. de l'acad. 1741.

(*b*) Meckren Obſerv. medico-chirurg. obſ. 71.—Ruyſch.
dverſ. dec. 2. § 2. obſerv. anat. chir. obſ. 4.—Van Swieten
Boerhaave Aphor. § 354.

(*c*) Hildan. centur. 5. obſ. 87. et cent. 6. obſ. 68.—
ilof. Tranſact. No. 494. § 21.

(*d*) Saltzman. Obſ. decur. obſ. 6.—Memoires de l'acad.
chirurgic. tom. 2. p. 155.—Bochmer Inſtit. oſteolog.
596.

Kerckingius (*a*), who gives us the delineatio of abortions from three days after conceptio and traces the oſſification of the bones fro three weeks, and a month, till the time the birth: To whom ſhould be added *Coiter* (*b*) and *Eyſſonius* (*c*). An account of this ſu ject might alſo be collected out of Ruyſch works, where ſome of the miſtakes committe by the former authors are corrected: and ſ veral more particulars, to make the hiſtory the *oſteogenea* more accurate, have ſince bee added by *Neſbit* (*d*) and *Albinus* (*e*).

I muſt refer to the authors now quoted f the more curious part of the human oſteogen not having preparations enough to give ſuch full hiſtory of it as is done by them. But ſhall endeavour to explain the more uſeful a neceſſary part of the oſteogeny, by ſubjoini to the deſcription of each bone of an adu its condition in ripe children; that is, in ſuc as are born at the ordinary time; and ſh point out what parts of each are afterwards joi ed in form of *epiphyſes*. This, with the fo lowing general rules, ſeem to me ſufficient f underſtanding what of this ſubject is neceſſa in the practice of phyſic and ſurgery.

1. Where-ever I mention any parts bei cartilaginous, or their being ſtill ſeparable fro the other parts of the bone to which they b lon

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(*a*) Anthropograph. ichnograph. et oſteogenea foetuum.

(*b*) De oſſibus foetus abortivi.

(*c*) De oſſibus infant. cognoſcend. et curand.

(*d*) Human Oſteogeny explained.

(*e*) Icones oſſium foetûs humani; accedit oſteogeneae br hiſtoria.

ong, I would be underſtood to hint, that, about ſeven or eight years of age, ſuch parts are oſſified and united to their proper bones, unleſs when it is ſaid, that they are afterwards formed nto *epiphyſes*.

2. Such as become *epiphyſes*, are generally oſſified at ſeven or eight years of age; but, beng for the moſt part moiſtened by *ſynovia*, heir external ſurface is ſtill ſomewhat cartilaginous, and they are not yet united to their bones.

3. At eighteen or twenty years of age the *epiphyſes* are entirely oſſified, and have blended heir fibres ſo with the body of the bone, as to make them inſeparable without violence.

The knowledge of this part of the *oſteogeny* think neceſſary, to prevent dangerous miſtakes n the cure of ſeveral diſeaſes. As for example: Without this knowledge, the ſeparation of an *epiphyſe* might be miſtaken for a fracture or uxation.——The interſtice of two parts of a bone not yet joined, might be judged to be a ſſure.——A *diaſtaſis*, or ſeparation of ſuch isjoined pieces of a bone, might be thought a racture.—The protruſion of one piece, or its verlopping any other, could be miſtaken for an xcreſcence or *exoſtoſis*.—Such errors about he nature of a diſeaſe would give one very ifferent indications of cure, from what he ould have, if he really underſtood his patient's ate. And very often the knowledge of the difrent inequalities on the ſurfaces of bones, uſt direct us in the execution of what is proer to be done to cure ſeveral of their diſeaſes.

Having thus conſidered the bones when ſingle, we ought next to ſhew the different manner of their conjunctions *. To expreſs theſe, anatomiſts have contrived a great number of technical terms; about the meaning, propriety, and claſſing of which, there has unluckily been variety of opinions. Some of theſe terms it is neceſſary to retain, ſince they ſerve to expreſs the various circumſtances of the articulations, and to underſtand the writers on this ſubject.

The ARTICULATIONS are moſt commonly divided into there claſſes, viz. *ſymphyſis*, *ſynarthroſis*, and *diarthroſis*.

Symphyſis, which properly ſignifies the concretion or growing together of parts, when uſed to expreſs the articulations of bones, does not ſeem to comprehend, under the meaning generally given to it, any thing relating to the form or motion of the conjoined bones; but by it moſt authors only denote the bones to be connected by ſome other ſubſtance; and as there are different ſubſtances which ſerve this purpoſe, therefore they divide it into the three following ſpecies:

1. *Synchondroſis* †, when a cartilage is the connecting ſubſtance: Thus the ribs are joined to the *ſternum*; thus the bodies of the *vertebræ* are connected to each other; as are likewiſe the *oſſa pubis*.

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† Σὺνταξις, σὺνθεσις, συμβολὴ, ὁμιλια, compoſitio, connexio, articulatio, conjunctio, nodus, commiſſura, ſtructura, compages.

† Amphiarthroſis.

2. *Synneuroſis*, or *ſyndeſmoſis*, when ligaments are the connecting bodies, as they are in all the moveable articulations.

3. *Syſſarcoſis*, when muſcles are ſtretched from one bone to another, as they muſt be where there are moveable joints.

The *ſecond* claſs of articulations, the *ſynarthroſis*, which is ſaid to be the general term by which the immoveable conjunction of bones is expreſſed, is divided into three kinds.

1. The *ſuture* * is that articulation where two bones are mutually indented into each other, or as if they were ſowed together, and is formed by the fibres of two bones meeting while they are yet flexible and yielding, and have not come to their full extent of growth; ſo that they mutually force into the interſtices of each other, till, meeting with ſuch reſiſtance as they are not able to overcome, they are ſtopped from ſprouting out farther, or are reflected; and therefore theſe indentations are very different both in figure and magnitude: Thus the bones of the head are joined; thus *epiphyſes* are joined to the bones, before their full connection and union with them.

Under this title of *ſuture*, the *harmonia* of the antients may be comprehended; ſcarce any unmoved bones being joined by plain ſurfaces (*a*).

2. *Gomphoſis* † is the fixing one bone into another, as a nail is fixed in a board: Thus the teeth are ſecured in their ſockets.

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* Ῥαφὴ.

(*a*) Veſal. Obſerv. Fallop. Examen.

† Conclavatio.

3. *Schindyleſis* or *ploughing* (*a*), when a thin *lamella* of one bone is received into a long narrow furrow of another: Thus the *proceſſus azygos* of the *ſphenoid*, and the naſal proceſs of the *ethmoid* bone, are received by the *vomer*.

The *third* claſs, or *diarthroſis* *, is the articulation where the bones are ſo looſely connected as to allow large motion. This is ſubdivided into three kinds.

The firſt is *enarthroſis*, or the ball and ſocket, when a large head is received into a deep cavity; as the head of the *os femoris* is into the *acetabulum coxendicis*.

The ſecond is *arthrodia*, when a round head is received into a ſuperficial cavity; as in the articulation of the arm-bone and *ſcapula*. Theſe two ſpecies of *diarthroſis* allow motion to all ſides.

The third is *ginglimus* †, which properly ſignifies the hinge of a door or window; in it the parts of the bones mutually receive and are received, and allow of motion two ways: Workmen call it *charnal*.

The *ginglimus* is generally divided into three kinds, to which ſome (*b*) give the names of *contiguous* ‡, *diſtant* ||, and *compound* §.

The firſt kind of *ginglimus* is, when a bone has ſeveral protuberances and cavities, which anſwer to as many cavities and proceſſes of the other

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(*a*) Keil, Anat. chap. 5. § 3.

* Απαρθρώσις, dearticulatio, abarticulatio.

† Articulatio mutua.

(*b*) Baker, Curſ. oſteolog. demonſtr. 1.

‡ Proximus.

|| Longus.

§ Compoſitus.

other bone, with which it is articulated; as in the conjunction of the *femur* with the *tibia*.

The ſecond ſpecies is, when a bone receives another at one end, and is received by the ſame bone at the other end; as in the *radius* and *ulna*.

The laſt ſort is, when a bone receives another, and is received by a third; as in the oblique proceſſes of the *vertebræ*.

When I firſt mentioned the articulations of bones, I ſaid there were different opinions concerning the uſe of their technical names, *e. g.* It has been ſaid, that *ſymphyſis* ſhould be the name for the immoveable articulations, and *ſynarthroſis* ſhould be underſtood to be the conjunction of bones by ſome connecting *medium.*——Thoſe who have taken *ſymphyſis* in the ſenſe I did, of its expreſſing the conjunction of bones with a connecting ſubſtance, have diſagreed in their definition of it; ſome inſerting, and others leaving out, its allowing motion.—Where they have agreed in their definition, they have not been of the ſame mind concerning the ſpecies of it. For ſeveral think the *Syſarcoſis* and *ſyndeſmoſis* applicable to ſo many joints which are univerſally allowed to be claſſed under the *diarthroſis*, that it muſt create confuſion to name them by any ſpecies of the *ſymphyſis*.——Few keep to ſuch a general definition of the *ſynchondroſis* as I have done; and, whether they determine it to allow no motion, or an obſcure or a manifeſt one, bring themſelves into difficulties, becauſe there are examples of all theſe three kinds.——Some again, by too nicely diſtinguiſhing obſcure and

manifeſt

manifeſt motions of bones, have blended the *ſynarthroſis* and *diarthroſis*, and from thence have branched out the different compound ſpecies of articulations that may be formed of them ſo far, that they could find no examples in the body to illuſtrate them by.—It would be tedious to enumerate more of the jarring opinions, and it would be far more ſo to give a detail of the arguments uſed by the diſputants. It is ſufficient for my purpoſe, that it is underſtood in what ſenſe I take theſe technical terms; which I do in the following manner.

When I mention the *ſymphyſis* or *ſynarthroſis*, or any ſpecies of them, I ſhall always underſtand them according to the explication already given of them. But though the preceeding account of the *diarthroſis*, or articulation of moveable bones, has been almoſt univerſally received; yet, ſeeing it does not comprehend all the moveable articulations of the body, and one of its ſpecies does not anſwer to any notion we can have of the conjunction of two bones, I muſt beg leave to change the definitions and kinds of theſe joints.

I would call *diarthroſis* that conjunction of bones, whereby they are fitted for motion, being each covered with a ſmooth cartilage, connected by one or more common ligaments, and lubricated with liquor at the conjoined parts. In which definition, I have no regard to the quantity of motion which they really do perform; the motion being often confined or enlarged by ſome other cauſe not immediately depending on the frame of the two ſurfaces of the

e bones forming the particular joint which
en is conſidered.

The firſt ſpecies of the *diarthroſis, viz.* the
arthroſis or ball and ſocket, I would define
ore generally than above, That articulation
here a round head of one bone is received in-
a cavity of another, and conſequently, with-
t ſome foreign impediment, is capable of mo-
on to all ſides. Examples of this kind are to
ſeen in the articulation of the thigh-bone
d *oſſa innominata*; Arm-bone and *ſcapula*;
ragalus and *os naviculare*; *magnum* of the
riſt, with the *ſcaphoides* and *lunare*; firſt bone
the thumb with the ſecond, *&c.*

The ſecond ſort, or the *arthrodia*, differing
om the *enarthroſis*, in the preceeding account,
ly in the cavity's being more ſuperficial,
hich makes no eſſential difference, eſpecially
at, in the recent ſubject, cartilages or liga-
ents ſupply the deficiency of bone, ought,
my opinion, to be called with *Veſalius* (*a*),
at articulation of two bones adapted for mo-
on, where it is not at firſt ſight obvious which
the two has the head or cavity, or where
ey are joined by plain ſurfaces, or nearly ſo;
ch is the conjunction of the *clavicle* with the
pula; *oſſa cuneiformia* with the *os navicu-*
e; *metatarſal* bones with the *oſſa cuneifor-*
ia, *&c.* From the nature of this ſort of
int, it is plain, that very great motion cannot
allowed, without the bones going farther out
their natural ſituation, than is convenient or
fe.

Ginglimus,

(*a*) De corp. human. fabrica, lib. 1. cap. 4.

Ginglimus, I would reckon that articulatio by the form of which the motion of the joine bones moſt be chiefly confined to two directions which hinges of doors are.

The firſt ſpecies of this is the *trochoide* when one bone turns on another, as a whee does on its axis: Thus the firſt *vertebra* of th neck moves on the tooth-like proceſs of th ſecond. This is the moſt proper kind of *gi* *glimus*.

The ſecond ſpecies ſhould be eſteemed tha articulation where ſeveral prominent and hol low ſurfaces of two bones move on each othe within the ſame common ligament; as in th knee, elbow, &c.

The third ſort of *ginglimus* is, when tw bones are articulated to each other at differe parts, with a diſtinct *apparatus* of the moto machines at each; ſuch is the articulation the *os occipitis* with the firſt *vertebra* of th neck; of any two contiguous *vertebræ*, by the oblique proceſſes; of the ribs with the bodi and tranverſe proceſſes of the *vertebræ*; of th *radius* with the *ulna*, *tibia* with the *fibul* *aſtragalus* with the *calcaneum*, &c.

I would entirely throw out what is commonl called the third kind of *ginglimus*: For, i examining the conjunction of a bone with tw others, as in the common example of a *vertebr* joined with the one above and below, the co nection of the middle one with each of the ther two ought to be conſidered ſeparately; therwiſe we might with the ſame propriety ſteem the articulations that the long bones, th *femur*, *tibia*, *humerus*, &c. have at their di

fere

rent ends, as one articulation; which is ab- rd.

If the moveable bones are not connected d kept firm by ſome ſtrong ſubſtance, they ould be luxated at every motion of the joints: d if their hard rough unequal ſurfaces were play on each other, their motion would not ly be difficult, but the loſs of ſubſtance from trition would be great. Therefore *ligaments* e made to obviate the firſt, and *cartilages* to event the other inconveniency. But becauſe gaments and cartilages turn rigid, inflexible, d rough, unleſs they are kept moiſt, a ſuffi- ent quantity of proper liquors is ſupplied for eir lubrication, and to preſerve them in a exible ſtate. Seeing then theſe parts are ſo ceſſary to the articulations, I ſhall next con- der their ſtructure, ſituation, and uſes, ſo far as ey are ſubſervient to the bones, and their mo- ns.

LIGAMENTS * are white flexible bodies, icker and firmer than membranes, and not ſo rd or firm as cartilages, without any remark- le cavity in their ſubſtance, difficultly ſtretch- , and with little elaſticity; ſerving to connect e part to another, or to prevent the parts to hich they are fixed from being removed out of at ſituation which is uſeful and ſafe.

After maceration in water, the ligaments n eaſily be divided; and each ligamentous yer appears compoſed of fibres, the largeſt which are diſpoſed in a longitudinal direc- n.

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* Σύνδεσμοι, νεῦροι, copulæ, vincula.

The *arteries* of ligaments are very conſpi
cuous after a tolerable injection, and the la
ger trunks of their veins are ſometimes to b
ſeen full of blood.

Such ligaments as form the ſides of ca
ties, have numerous orifices of their arteri
opening upon their internal ſurface, which kee
it always moiſt: If we rub off that moiſtur
and then preſs the ligament, we can ſee th
liquor ouſing out from ſmall pores; and we ca
force thin liquors injected by the arteries int
the cavities formed by ligaments.

Theſe exhalent arteries muſt have correſpon
ing abſorbent *veins*, otherwiſe the cavities wou
ſoon be too full of liquor.

Ligaments then muſt be ſubject to the di
eaſes common to other parts, where there is
circulation of fluids, allowance always bei
made for the ſize of veſſels, nature of th
fluids, and firmneſs of the texture of eac
part.

Authors generally ſay, that ligaments a
inſenſible: and conſequently it may be infe
red, that they have no nerves beſtowed on the
But the violent racking pain felt on the le
motion of a joint labouring under a *rheum*
tiſm, the ſeat of which diſeaſe ſeems often t
be in the ligaments, and the inſufferable to
ture occaſioned by inciſions of ligaments, an
by a collection of acrid matter in a joint,
by *tophi* in the gout, would perſuade us, th
they are abundantly ſupplied with nerves.

The ligaments which connect the mov
able bones commonly riſe from the conjun
tion of the *epiphyſes* of the one bone, an

inſerted into the ſame place of the other;
where *epiphyſes* are not, they come out
m the *cervix*, and beyond the *ſupercilia* of
articulated bones; and after ſuch a manner,
oth caſes, as to include the articulation in
urſe or bag, with this difference, depend-
on their different motions, that where the
tion is only to be in two directions, the
ments are ſtrongeſt on thoſe ſides towards
ich the bones are not moved; and when a
at variety of motions is deſigned to be al-
ed, the ligaments are weaker than in the
mer ſort of articulations, and are nearly of
ſame ſtrength all round.

Part of the capſular ligaments is compoſed
the *perioſteum*, continued from one bone to
ther, as was obſerved *p.* 2. and their inter-
layer is continued on the parts of the bone
cartilage which the ligament includes (*a*).

Beſides theſe common capſular ligaments
he joints, there are particular ones in ſe-
l places, either for the firmer connection
the articulated bones, or for reſtraining
confining the motion to ſome one ſide;
are the *croſs* and *lateral* ligaments of the
e, the *round* one of the thigh, *&c.*

From this account of the ligaments, we
conclude, that, *cæteris paribus*, in what-
articulation the ligaments are few, long,
weak, the motion is more free and quick;
luxations happen frequently: And, on the
trary, where the ligaments are numerous,
t, and ſtrong, the motion is more confined;
ſuch a joint is leſs expoſed to luxations

(*a*)

) Neſbit, Oſteogen.—Philoſ. tranſact. No. 470. § 6.

(*a*).——Whence we may judge how neceſſary it is to attend to the different ligaments, an the changes which have been made on the by a luxation, when it is to be reduced.

Ligaments alſo ſupply the place of bones i ſeveral caſes to advantage: Thus the parts i the *pelvis* are more ſafely ſupported below b ligaments, than they could have been b bone. —— The ligaments placed in the grea holes of the *oſſa innominata*, and between th bones of the fore-arm and leg, afford conve nient origin to muſcles. — Immoveable bone are firmly connected by them; of which th conjunction of the *os ſacrum* and *innominatu* is an example.——They afford a ſocket fo moveable bones to play in, as we ſee part the *aſtragalus* does on the ligament ſtretc ed from the heel-bone to the *ſcaphoid*.

Numerous inconveniencies may ariſe fro too long or ſhort, ſtrong or weak, lax or rig ligaments.

Cartilages * are ſolid, ſmooth, whi elaſtic ſubſtances, between the hardneſs bones and ligaments, and covered with membrane, named *perichondrium*, which is the ſame ſtructure and uſe to them as the *riosteum* is to the bones.

Cartilages are compoſed of plates, which formed of fibres, diſpoſed much in the ſa way as thoſe of bones are; as might be r ſonably concluded from obſerving bones in cartilaginous ſtate before they oſſify, and fr ſeeing, on the other hand, ſo many cartila become bony. This may be ſtill further c firm

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(*a*) Fabric. ab Aquapend. de articul. part. utilit. pars 3.

* Χονδροί.

firmed, by the *exfoliation* which cartilages are ſubject to, as well as bones.

The *perichondrium* of ſeveral cartilages, for xample, thoſe of the ribs and *larynx*, has rteries which can be equally well injected vith thoſe of the *perioſteum*; but the veſſels of hat membrane in other parts, *e. g.* the arti-ular cartilages, are ſmaller, and in none of them oes injection enter deep into the ſubſtance of he cartilages; nay, madder, mixed with the ood of animals, does not change the colour f cartilages, as it does that of bones (*a*).

The granulated fleſh which riſes from the nds of metacarpal or metatarſal bones, when he cartilage exfoliates, after a finger or toe as been taken off at the firſt joint, is very nſible, from which the exiſtence of nerves cartilages may be inferred.

While cartilages are in a natural ſtate, it is be remarked, *firſt*, That they have no ca-ty in their middle for marrow. *Secondly*, hat their outer ſurface is ſofteſt, which ren-rs them more flexible. *Thirdly*, That they not appear to change their texture near ſo uch by acids as bones do. And, *laſtly*, That the ſpecific gravity of cartilages is near a ird leſs than that of bones; ſo the coheſion their ſeveral plates is not ſo ſtrong as in nes: whence cartilages laid bare in wounds ulcers, are not only more liable to corrupt, t exfoliate much ſooner than bones do.

(*a*) Philoſ. Tranſact. No. 442. art. 8. No. 443. art. 2. . 457 art 4. Mem. de l'acad. des ſciences 1739 et 42. —Dehtleef de oſſium callo.

Cartilages ſeem to be principally kept from oſſifying, either by being ſubjected to alternate motions of flexion and extenſion, the effects of which are very different from any kind of ſimple preſſure, or by being conſtantly moiſtened (*a*): Thus, the cartilages on the articulated ends of the great bones of the limbs, and the moveable ones placed between the moving bones in ſome articulations, which are obliged to ſuffer many and different flexions, and are plentifully moiſtened, ſcarce ever change into bone; while thoſe of the ribs and larynx are often oſſified.——The middle angular part of the cartilages of the ribs, which is conſtantly in an alternate ſtate of flexion and extenſion, by being moved in reſpiration, is always the laſt of becoming bony.——In the *larynx*, the *epiglottis*, which is oftener bended and more moiſtened than the other four cartilages, ſeldom is oſſified, while the others as ſeldom eſcape it in adults.

The cartilages ſubſervient to bones, are ſometimes found on the ends of bones which are joined to no other; but are never wanting on the ends, and in the cavities of ſuch bones as are deſigned for motion (*b*). Cartilages alſo are interpoſed between ſuch other cartilages as cover the heads and cavities of articulated bones; nay, they are alſo placed between immoveable bones.

The uſes of cartilages, ſo far as they regard bones, are, to allow, by their ſmoothneſs, ſuch bones as are deſigned for motion, to ſlide eaſily

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(*a*) Havers Oſteolog. nov.

(*b*) Celſ. de re medic. lib. 8. cap. 1.

ſily without detrition, while, by their flexibility, they accommodate themſelves to the ſeveral figures neceſſary in different motions, and, by their elaſticity, they recover their natural poſition and ſhape as ſoon as the preſſure is removed.——This ſpringy force may alſo aſſiſt the motion of the joint to be more expeditious, and may render ſhocks in running, umping, *&c.* leſs.——To theſe Cartilages we hiefly owe the ſecurity of the moveable articulations: For without them the bony fibres would ſprout out, and intimately coaleſce with he adjoining bone; whence a true *anchyloſis* muſt neceſſarily follow; which never fails to happen when the cartilages are eroded by acrid matter, or oſſified from want of motion r defect of liquor, as we ſee often happens fter wounds of the joints, *paidarthrocace*, *crophula*, and *ſpina ventoſa*, or from old age, nd long immobility of joints (*a*).—Hence we ay know what the annihilation is which is id to be made of the head of a bone, and of e cavity for lodging it, after an unreduced racture (*b*). The moveable cartilages interpoſed in joints ſerve to make the motions oth freer and more ſafe than they would otherwiſe be.——Thoſe placed on the ends of ones that are not articulated, as on the *ine* of the *os illium*, baſe of the *ſcapula*, *&c.* ſerve

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(*a*) Columb. de re anat. lib. 15.—Deſlandes Hiſt. de l'a-d. des ſciences 1716 —Phil. tranſact. No. 215.—Ibid. o. 461 § 16.

(*b*) Hildan. de ichor. et melicer. acri Celſi, cap. 5.—Ruyſch. heſ. 8. No. 103.—Saltzman in act. Petropolit. Tom. 3. 275.

ſerve to prevent the bony fibres from growing out too far.-——Cartilages ſometimes ſerve as ligaments, either to faſten together bones that are immoveably joined, ſuch are the cartilages between the *os ſacrum* and *oſſa illium*, the *oſſa pubis*, *&c.* or to connect bones that enjoy manifeſt motion, as thoſe do which are placed between the bodies of the true *vertebræ*, *&c.*—Cartilages very often do the office of bones to greater advantage than theſe laſt could, as in the cartilages of the ribs, thoſe which ſupply brims to cavities, *&c.*

Too great thickneſs or thinneſs, length or ſhortneſs, hardneſs or ſuppleneſs of cartilages, may therefore cauſe great diſorders in the body.

The liquor, which principally ſerves to moiſten the ligaments and cartilages of the articulations, is ſupplied by glands, which are commonly ſituated in the joint, after ſuch a manner as to be gently preſſed, but not deſtroyed by its motion. By this means, when there is the greateſt neceſſity for this liquor, that is, when the moſt frequent motions are performed, the greateſt quantity of it muſt be ſeparated. Theſe glands are ſoft and pappy, but not friable: In ſome of the large joints they are of the conglomerate kind, or a great number of ſmall glandules are wrapt up in one common membrane. Their excretory ducts are long, and hang looſe, like ſo many fringes, within the articulation; which, by its motion and preſſure, prevents obſtructions in the body of the gland or its excretories, and promotes the return of this liquor, when fit to be taken up by the abſorbent veſſels, which muſt be in the joints, as well as in the other cavities of the body; and, at the ſame time, the preſſure on the excretory ducts hinders a ſuperfluous unneceſſary ſecretion, while the fimbriated diſpoſition of theſe excretories does not allow any of the ſecreted liquor to be puſhed back again by theſe canals towards the glands (*a*).

Very often theſe fountains of ſlimy liquor appear only as a net-work of veſſels.——Frequently they are almoſt concealed by cellular membranes containing the fat—and ſometimes ſmall ſimple mucous *folliculi* may be ſeen (*b*).

The different joints have theſe organs in different numbers and ſizes; the conglomerate ones don't vary much, eſpecially as to ſituation, in the ſimilar joints of different bodies: but the others are more uncertain.

Upon preſſing any of theſe glands with the finger, one can ſqueeze out of their excretories a mucilaginous liquor, which ſomewhat reſembles the white of an egg, or *ſerum* of the blood; but it is manifeſtly ſalt to the taſte. It does not coagulate by acids or by heat, as the *ſerum* does, but by the latter turns firſt thinner, and, when evaporated, leaves only a thin ſalt film.

The quantity of this *mucilage*, conſtantly ſupplied, muſt be very conſiderable, ſince we ſee what a plentiful troubleſome diſcharge of glary matter follows a wound or ulcer of any joint;

(*a*) Cowper, Anatom. explicat. tab. 79. lit. E. E.
(*b*) Morgagn. Adverſar. 2. animad. 23.

joint; of which liquor the mucilage is a conſiderable part.

The veſſels which ſupply liquors for making the ſecretion of this mucilage, and the veins which bring back the blood remaining after the ſecretion, are to be ſeen without any preparation; and, after a tolerable injection of the arteries, the glands are covered with them.

In a ſound ſtate, we are not conſcious of any ſenſibility in thoſe glands; but, in ſome caſes which I have ſeen, when they inflame and ſuppurate, the moſt racking pain is felt in them: a melancholy, though a ſure proof that they have nerves.

Theſe mucilaginous glands are commonly lodged in a cellular ſubſtance; which is alſo to be obſerved in other parts of the bag formed by the ligaments of the articulation; and contains a fatty matter, that muſt neceſſarily be attenuated, and forced through the including membranes into the cavity of the joint, by the preſſure which it ſuffers from the moving bones.

If then the oil is conveyed from this cellular ſubſtance; and if the attenuated marrow paſſes from the *cancelli* of the bones by the large pores near their ends, or in their cavities, and ſweats through the cartilages there into the articulations; which it may, when aſſiſted by the conſtant heat and action of the body, more eaſily do, than when it eſcapes through the compact ſubſtance of the bones in a ſkeleton: If, I ſay, this oil is ſent to oint, and is incorporated with the mucilage, nd with the fine lymph that is conſtantly uſing out at the extremities of the ſmall arries diſtributed to the ligaments, one of e fitteſt *liniments* imaginable muſt be produed; for the *mucus* diluted by the lymph conibutes greatly to its lubricity, and the oil eſerves it from hardening. How well ſuch mixture ſerves the purpoſe it is deſigned for *oyle* (*a*) tells us he experienced in working s air-pump; for the ſucker could be moved ith much leſs force after being moiſtend with water and oil, than when he uſed ther one or other of theſe liquors: And I beve every one, at firſt view, will allow the luted mucilage to be much preferable to ſime water. The *ſynovia* *, as this liquor comoſed of oil, mucilage, and lymph, is commonly ow called, while in a ſound ſtate, effectually eſerves all the parts concerned in the articutions ſoft and flexible, and makes them ſlide ſily on each other, by which their mutual trition and overheating is prevented, in the anner daily practiſed in coach and cart heels, by beſmearing them with greaſe and r.

After the liquor of the articulations becomes o thin and unſerviceable, by being conſtantly unded and rubbed between the moving bones, is reaſſumed into the maſs of blood by the orbent veſſels.

When the *ſynovia* is not rubbed betwixt the ones, it inſpiſſates. And ſometimes, when the

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(*a*) Phyſico-mechanic experim.

* Μύξα, mucus, axungia.

the head of a bone has been long out of its cavity, this liquor is ſaid to fill up the place of the bone, and hinder its reduction; or if a joint continues long unmoved, it is alſo ſaid to cement the bones, and occaſion a true *anchyloſis* (*a*).———If the *ſynovia* becomes too acrid, it erodes the cartilages and bones; as frequently happens to thoſe who labour unde the *lues venerea*, *ſcurvy*, *ſcrophula*, or *ſpin ventoſa*.——If this liquor is ſeparated in too ſmall quantity, the joint becomes ſtiff; and when with difficulty it is moved, a crackling noiſe is heard, as people advanced in years frequently experience (*b*).—If the mucilag and lympth are depoſited in too great quantity and the abſorbent veſſels do not perform thei office ſufficiently, they may occaſion a dropſy of the joints (*c*).—From this ſame cau alſo the ligaments are often ſo much relaxe as to make the conjunction of the bones ver weak: Thence ariſe the luxations from an i ternal cauſe, which are eaſily reduced, but di ficultly cured (*d*)——Frequently, when ſuc a ſuperfluous quantity of this liquor is pent u it becomes very acrid, and occaſions a gre train of bad ſymptoms; ſuch as ſwelling an pain of the joints, long ſinuous ulcers and *ſtulæ*, rotten bones, immobility of the joint

marc

(*a*) Pare, Chirurgie, livre 15 chap. 18. et livre chap. 5.

(*b*) Galen de uſu part. lib. 12. cap. 2.——Fabric. Aquapend. de articul. part. utilitat pars 3.——Bartho Hiſt. medic. cent. 3. hiſt. 11.

(*c*) Hildan. de ichore et meliceria acri Celſi.

(*d*) Hippocrat. de locis in homine, § 14. et de articul.

arcor and *atrophia* of the whole body, hectic vers, &c. (d)—From a depravity in the od or diſeaſes in the organs that furniſh the *novia* of the joints, it may be greatly chan- ed from its natural ſtate; it may be purulent ter inflammation, mucous in the white ſwell- gs, gelatinous in the rheumatiſm, chalky on the gout, &c.; hence a great variety of orders in the joints (e).

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(d) Hildan. de ichore et meliceria acri Celſi.

(e) See Reimar Diſſert. de fungo articulor.

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THE
ANATOMY
OF THE
HUMAN BONES.

PART II.

Of the SKELETON.

THOUGH any dry ſubſtance may be
called *ſkeleton*, yet, among anatomiſts,
this word is univerſally underſtood to
ify the bones of animals connected together,
r the teguments, muſcles, bowels, glands,
ves, and veſſels are taken away *.

A ſkeleton is ſaid to be a *natural* one, when
bones are kept together by their own li-
nents; and it is called *artificial*, wher the
es are joined with wire, or any other ſub-
ce which is not part of the creature to
ch they belonged. Small ſubjects, and ſuch
ſe bones are not fully oſſified, are com-
nly prepared the firſt way; becauſe, were
all

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* Cadaveris crates.

all their parts divided, the niceſt artiſt coul
not rejoin them, by reaſon of their ſmallneſs
and of the ſeparation of their unoſſified parts
whereas the bones of large adult animals ar
ſooneſt and moſt conveniently cleaned whe
ſingle, and are eaſily reſtored to, and kept i
their natural ſituation.— Sometimes the ſkel
ton of the ſame animal is prepared in bo
theſe ways; that is, the ſmaller bones are ke
together by their natural ligaments, and th
larger ones are connected by wires, or ſom
ſuch ſubſtances.

Before we proceed to the diviſion and pa
ticular deſcription of the ſkeleton, it is wort
while to remark, that when the bones are p
into their natural ſituation, ſcarce any one
them is placed in a perpendicular bearing
another; though the fabric compoſed
them is ſo contrived, that, in an erect poſtur
a perpendicular line, from their common ce
ter of gravity, falls in the middle of th
common baſe (*a*). On this account, we c
ſupport ourſelves as firmly, as if the axis
all the bones had been a ſtreight line perp
dicular to the horizon; and we have mu
greater quickneſs, eaſe, and ſtrength in ſe
ral of the moſt neceſſary motions we perfor
It is true indeed, that where-ever the bon
on which any part of our body is ſuſtain
decline from a ſtreight line, the force r
quired in the muſcles, to counteract the gra
ty of that part, is greater than otherwiſe
need

(*a*) Cowper Anat. of human bodies, explic. of tab.
88.

needed to have been: But then this is effectually provided for in ſuch places, by the number and ſtrength of the muſcles. So long therefore as we remain in the ſame poſture, a conſiderable number of muſcles muſt be in a conſtant ſtate of contraction; which we know, both from reaſon and experience, muſt ſoon create an uneaſy ſenſation. This we call, being weary of one poſture: An inconvenience that we ſhould not have had in ſtanding erect, if the bearing of all the bones to each other had been perpendicular; but is more than compenſated by the advantages above mentioned.

The human ſkeleton is generally divided into the HEAD, the TRUNK, the SUPERIOR and the INFERIOR EXTREMITIES.

OF THE HEAD.

BY the *HEAD* is meant all that ſpheroidal part which is placed above the firſt bone of the neck. It therefore comprehends the *cranium* and bones of the *face*.

The *cranium* *, helmet, or brain-caſe, conſiſts of ſeveral pieces, which form a vaulted cavity, for lodging and defending the brain nd *cerebellum*, with their membranes, veſſels, nd nerves.

The cavity of the *cranium* is proportioned o its contents. Hence ſuch a variety of its ize is obſerved in different ſubjects; and hence t is neither ſo broad nor ſo deep at its fore-

F part,

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* Κογχος, κύτος, κώδεια, σκαφίον, calva, calvaria, cerebri alea, theca et olla capitis, teſta capitis, ſcutella capitis.

part, in which the anterior lobes of the brain are lodged, as it is behind, where the large poſterior lobes of the brain, and the whole *cerebellum*, are contained.

The roundiſh figure of the ſcull, which makes it more capacious, and better able to defend its contents from external injuries, is chiefly owing to the equal preſſure of theſe contained parts as they grow and increaſe before it is entirely oſſified.——It is to be obſerved, however, that the ſides of the *cranium* are depreſſed below a ſpherical ſurface by the ſtrong temporal muſcles, whoſe action hinders here the uniform protruſion of the bones, which is more equally performed in other parts, where no ſuch large muſcles are. In children, whoſe muſcles have not acted much, and conſequently have not had great effects on the bones, this depreſſion is not ſo remarkable; and therefore their heads are much rounder than in adults. Theſe natural cauſes, differently diſpoſed in different people, produce a great variety in the ſhapes of ſculls, which is ſtill increaſed by the different management of the heads of children when very young: So that one may know a *Turk*'s ſcull by its globular figure, a *German*'s by its breadth and flatneſs of the *occiput*, *Dutch* and *Engliſh* by their oblong ſhapes, *&c.* (*a*). Two advantages are reaped from this flatneſs of the ſides of the *cranium*, *viz.* the enlargement of our ſphere of viſion, and more advantageous ſituation of our ears, for receiving a greater quantity of ſound, and for being leſs expoſed to injuries.

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(*a*) Veſal. lib. 1. c. 5.

The external ſurface of the upper part of the *cranium* is very ſmooth, and equal, being only covered with the *perioſteum*, (common to all the bones; but in the ſcull, diſtinguiſhed by the name of *pericranium*), the thin *frontal* and *occipital* muſcles, their tendinous *aponeuroſis*, and with the common teguments of the body; while the external ſurface of its lower part has numerous riſings, depreſſions, and holes, which afford convenient origin and inſertion to the muſcles that are connected to it, and allow ſafe paſſage for the veſſels and nerves that run through and near it.

The internal ſurface of the upper part of the ſcull is commonly ſmooth, except where the veſſels of the *dura mater* have made furrows in it, while the bones were ſoft.——Surgeons ſhould be cautious when they trepan here, leſt, in ſawing or raiſing the bone where ſuch furrows are, they wound theſe veſſels.——In the upper part of the internal ſurface of ſeveral ſculls, there are likewiſe pits of different magnitudes and figures, which ſeem to be formed by ſome parts of the brain being more luxuriant and prominent than others. Where theſe pits are, the ſcull is ſo much thinner than any where elſe, that it is often rendered diaphanous, the two tables being cloſely compacted without a *diploe;* the want of which is ſupplied by veſſels going from the *dura mater* into a great many ſmall holes obſervable in the pits. Theſe veſſels are larger, and much more conſpicuous than any others that are ſent from the *dura mater* to the ſcull; as evidently appears from the drops of blood they pour out, when the ſcull is raiſed from the *dura mater* in a recent ſubject; and therefore they may furniſh a ſufficient quantity of liquors neceſſary to prevent the brittleneſs of this thin part——The knowledge of theſe pits ſhould teach ſurgeons to ſaw cautiouſly and ſlowly through the external table of the ſcull, when they are performing the operation of the *trepan;* ſince, in a patient whoſe *cranium* has theſe pits, the *dura mater* and brain may be injured, before the inſtrument has pierced near the ordinary thickneſs of a table of the ſcull.——The internal baſe of the ſcull is extremely unequal, for lodging the ſeveral parts and *appendices* of the brain and *cerebellum,* and allowing paſſage and defence to the veſſels and nerves that go into, or come out from theſe parts.

The bones of the *cranium* are compoſed of two tables, and intermediate *cancelli,* commonly called their *diploe* *. The external table is thickeſt; the inner, from its thinneſs and conſequent brittleneſs, has got the name of *vitrea.* Whence we may ſee the reaſon of thoſe miſchievous conſequences which ſo often attend a collection of matter in the *diploe,* either from an external or internal cauſe, before any ſign of ſuch a collection appears in the teguments that cover the part of the ſcull where it is lodged (*a*).

The *diploe* has much the ſame texture and uſes in the ſcull, as the *cancelli* have in other bones.

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* Meditullium, commiſſura.

(*a*) Bonet. Sepulchret anat. lib. 1. § 1. obſ. 96.—103.

The *diploe* of ſeveral old ſubjects is ſo oblite-ated, that ſcarce any veſtige of it can be ſeen ; neither is it obſervable in ſome of the hard craggy bones at the baſe of the ſcull. Hence n uſeful caution to ſurgeons who truſt to the bleeding, want of reſiſtance, and change of ound, as certain marks in the operation f the trepan, for knowing when their in-rument has ſawed through the firſt table, nd reached the *diploe* (*a*). In other people, he *diploe* becomes of a monſtrous thickneſs, while the tables of the ſcull are thinner than aper.

The *cranium* conſiſts of eight bones, ſix of hich are ſaid to be proper, and the other two e reckoned common to it and to the face.—The ſix proper are the *os frontis*, two *oſſa pa-ietalia*, two *oſſa temporum*, and the *os occipi-s*.——The common are the *os ethmoides* and *henoides*.

The *os frontis* forms the whole fore-part of e vault ; the two *oſſa parietalia* form the up-er and middle part of it ; the *oſſa temporum* ompoſe the lower part of the ſides ; the *os cipitis* makes the whole hinder part, and ſome f the baſe ; the *os ethmoides* is placed in the re part of the baſe, and the *os ſphenoides* is the middle of it.

Theſe bones are joined to each other by five *tures ;* the names of which are the *coronal*, *mbdoid*, *ſagittal*, and two *ſquamous*.

The *coronal* * ſuture is extended over the ad, from within an inch or ſo of the exter-

nal

(*a*) Bartholin. Anat. reform. lib. 4. cap. 4.

* Στεφανιαῖα, arcualis, puppis.

nal *canthus* of one eye, to the like diſtance from the other; which being near the place where the antients wore their *vittæ*, *coronæ*, or garlands, this ſuture has hence got its name.–Though the indentations of this ſuture are conſpicuous in its upper part, yet an inch or more of its end on each ſide has none of them; for it is ſquamous and ſmooth there.

The *lambdoidal* * ſuture begins ſome way below, and farther back than the *vertex* or crown of the head, whence its two legs are ſtretched obliquely downwards, and to each ſide in form of the *Greek* letter Λ, and are now generally ſaid to extend themſelves to the *baſe* of the ſcull; but formerly anatomiſts (*a*) reckoned the proper *lambdoid* ſuture to terminate at the *ſquamous* ſutures, and what is extended at an angle down from that on each ſide, where the indentations are leſs conſpicuous than in the upper part of the ſuture, they called *additamentum ſuturæ lambdoidis* †.

This *ſuture* is ſometimes very irregular, being made up of a great many ſmall ſutures which ſurround ſo many little bones that are generally larger and more conſpicuous on the external ſurface of the ſcull, than internally. Theſe bones are generally called *triquetra* or *Wormiana*; but ſome other name ought to be given them, for they are not always of a tria

gula

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* Laudæ, proræ, hypſyloides.

(*a*) Veſal, Anat. lib. 1 cap. 6.

† Lambdoides harmonialis, lambdoides inferior, occip
corona.

lar figure; and older anatomiſts (*a*) than *aus Wormius* (*b*) have deſcribed them.—The ecific virtue which theſe bones were once ought to have in the cure of the epilepſy (*c*) not now aſcribed to them; and anatomiſts nerally agree, that their formation is owing a greater number of points than ordinary oſſification in the ſcull, or to the ordinary nes of the *cranium* not extending their oſ- ication far enough or ſoon enough; in which ſe, the unoſſified interſtice between ſuch nes begins a ſeparate oſſification in one or ore points: from which the oſſification is ex- nded to form as many diſtinct bones as there ere points that are indented into the large dinary bones, and into each other.—Probably oſe children who have a large opening in is place at their birth, will have the largeſt *a triquetra.*———Tó confirm this account of e formation of theſe little bones, we may mark, that ſuch bones are ſometimes ſeen in her ſutures, as well as in the *lambdoid* (*d*), d they are ſometimes in one table of the ll, and not in the other (*e*).

The *ſagittal* ſuture * is placed longitudinally the middle of the upper part of the ſcull, and

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(*a*) Euſtach. Oſſium examen.—Bauhin Theat. anat. lib. cap. 5. - Paaw in Hippocrat. de vulner. cap. p. 56.

(*b*) Muſæum, lib. 3. cap. 26.

(*c*) Bauhin. et Paaw. ibid Bartholin. Anat. reform. lib. 4. . 5 — Hildan, Epiſtol. 65

(*d*) See examples in Veſal lib. 1. cap. 6. fig. 4.— Paaw Hippocrat. de cap. vuln.—Bartholin. Hiſt anat. cent. 1. t. 51.—Ruſch. Muſ. anat.—Sue Trad. d'oſteolog. p. 47.

(*e*) Hunald. in Mem. de l'acad. des ſciences, 1730.

* Ῥαβδοειδὴς, ὀϐελαία, ἐπιζευγνυσα, Inſtar virgae, nervalis, ar teli, inſtar veru, ſecundum capitis longitudinem prore- ns, conjungens, columnalis, recta, acualis.

and commonly terminates at the middle of the *coronal*, and of the *lambdoid* ſutures; between which it is ſaid to be placed, as an arrow is between the ſtring and bow.—However this ſuture is frequently continued through the middle of the *os frontis*, down to the root of the noſe; which, ſome (*a*) ſay, oftener happens in women than men; but others (*b*) alledge, that it is to be met with more frequently in male ſculls than in female: Among the ſculls, which I have ſeen thus divided, the female are the moſt numerous.——Several (*c*) have delineated and deſcribed the *ſagittal* ſuture, ſometimes dividing the *occipital* bone as far down as the great hole through which the *medulla ſpinalis* paſſes. This I never ſaw.

In ſome old ſculls that are in my poſſeſſion, there is ſcarce a veſtige of any of the three *ſutures* which I have now deſcribed. In other heads, one or two of the ſutures only diſappear; but I never could diſcover any reaſon for thinking them diſpoſed in ſuch different manners in ſculls of different ſhapes, as ſome antients alledge they are (*d*)

The *ſquamous agglutinations*, or *falſe ſutures* †, are one on each ſide, a little above the ear, of a ſemicircular figure, formed by the over-

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(*a*) Riolan. Comment. de oſſib. cap. 3.

(*b*) Veſal. lib. 1. cap. 6. et in epitome.

(*c*) Veſal. lib. 1. cap. 5. fig. 3. 4. et in text. cap. 6.—Paaw in Celſ. de re medic. cap 1.—Laurent. Hiſt. anat. lib. 2. cap. 16.

(*d*) Hippocrat. de vulner. capitis, § 1.—Galen, de oſſib. et de uſu part. lib. 9 cap. 17.

† Λεπιδοειδῆ, προσκολλήματα, κροταφίαι, temporales, corticales, mendoſæ, harmoniales, commiſſuræ in unguem.

erlopping (like one ſcale upon another) of e upper part of the *temporal* bones on the ver part of the *parietal*, where, in both nes, there are a great many ſmall riſings d furrows, which are indented into each o- r; though theſe inequalities do not appear the bones are ſeparated. In ſome ſculls in- ed the indentations here are as conſpicuous ternally as in other ſutures (*a*); and what is mmonly called the poſterior part of this ſqua- ous ſuture, always has the evident ſerrated m; and therefore is reckoned by ſome (*b*), diſtinct ſuture, under the name of *addita- ntum poſterius ſuturæ ſquamoſæ.*——I have n too ſquamous ſutures on the ſame temple, h a ſemicircular piece of bone between m (*c*).

We ought here to remark, that the true amous ſort of ſuture is not confined to the junction of the temporal and parietal bones, is made uſe of to join all the edges of the es on which each temporal muſcle is placed : For the two parts of the ſphenoidal ſuture ich are continued from the anterior end of common ſquamous ſuture juſt now deſcri- , of which one runs perpendicularly down- rds, and the other horizontally forwards, and the lower part of the coronal ſuture alrea- taken notice of, may all be juſtly ſaid to pertain

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) Columb. de re anat. lib. 1. cap. 4.—Dionis. Anat. 3. onſt. des os.

) Albin. de oſſib. § 54.

) Sue Trad. d'oſteolog. p. 48.

) Veſal. Anat. lib. 1. cap. 6.—Winſlow, Mem. de l'Acad. ſciences, 1720.

pertain to the ſquamous *ſuture*——The mann
how I imagine this ſort of ſuture is formed a
theſe places, is, That, by the action of th
ſtrong temporal muſcles on one ſide, and b
the preſſure of the brain on the other, th
bones are made ſo thin, that they have no
large enough ſurfaces oppoſed to each other t
ſtop the extenſion of their fibres in length, an
thus to cauſe the common ſerrated appearanc
of ſutures explained in p. 39. but the narro
edge of the one bone ſlides over the othe
The *ſquamous* form is alſo more convenie
here; becauſe ſuch thin edges of bones, whe
accurately applied one to another, have ſcar
any rough ſurface, to obſtruct or hurt the mu
cle in its contraction; which is ſtill further pro
vided for, by the manner of laying theſe e
ges on each other; for, in viewing their ou
ſide, we ſee the temporal bones covering th
ſphenoidal and parietal, and this laſt ſuppor
ing the ſphenoidal, while both mount on th
frontal: from which diſpoſition it is eviden
that while the temporal muſcle is contractin
which is the only time it preſſes ſtrongly in i
motion on the bones, its fibres ſlide eaſily ov
the external edges. Another advantage ſ
in this is, that all this bony part is made ſtron
er by the bones thus ſupporting each other.

The bones of the ſcull are joined to tho
of the face, by *ſchyndeleſis* and *ſutures.*—T
ſchyndeleſis is in the partition of the noſe.—
The ſutures ſaid to be common to the *crani*
and face are five, *viz.* the *ethmoidal*, *ſphen*
dal, *tranſverſe*, and two *zygomatic*.—Parts ho

e

of theſe ſutures are at the junction of on-
he bones of the ſcull.

'he *ethmoidal* and *ſphenoidal* ſutures ſur-
nd the bones of theſe names; and in ſome
es help to make up other ſutures, particu-
the *ſquamous* and *tranſverſe*; and in o-
parts there is but one ſuture common to
e two bones.

'he *tranſverſe* ſuture is extended quite croſs
face, from the external *canthus* of one or-
o the ſame place of the other, by ſinking
n the *canthus* down the outſide of the or-
o its bottom; then mounting upon its in-
it is continued by the root of the noſe
n the internal part of the other orbit, and
up again on its outſide to the other *can-*
. It may be here remarked, that there are
interruptions of this ſuture in the courſe
ve deſcribed; for the bones are not con-
ous every where, but are ſeparated, to
holes and apertures, to be mentioned
after.

he *zygomatic* ſutures are one on each ſide,
g ſhort, and ſlanting from above obliquely
nwards and backwards, to join a proceſs of
cheek-bone to one of the *temporal* bones,
h advances towards the face; ſo that the
proceſſes thus united, form a ſort of bridge,
jugum, under which the *temporal* muſcle
es; on which account the proceſſes, and ſu-
joining them, have been called *zygomatic*.

muſt be obſerved, that the indentations of
ſutures do not appear on the inſide of the
ium, by much ſo ſtrong as on the out-ſide;
he bones ſeem almoſt joined in a ſtreight
line:

line: nay, in ſome ſculls, the internal ſu
face is found entire, while the ſutures are m
nifeſt without; which may poſſibly be owing
the leſs extent of the concave than of the co
vex ſurface of the *cranium*, whereby the
bres of the internal ſide would be ſtretch
farther out at the edges of the bones, than t
exterior ones, if they were not reſiſted. T
reſiſtances are the fibres of the oppoſite bo
the parts within the ſcull, and the *diploe*;
which the laſt being the weakeſt, the moſt a
vanced fibres or *ſerræ* run into it, and le
the contiguous edges equal, and more ready
unite: whereas the *ſerræ* of the external ta
have ſpace enough for their admiſſion betw
the fibres of the oppoſite bone, and theref
remain of the indented form, and are leſs
ble to the concretion, whereby the ſutu
are obliterated (*a*).———By this mechaniſ
there is no riſk of the ſharp points of the bo
growing inwards, ſince the external *ſerra*
each of the conjoined bones reſt upon the
ternal ſmooth-edged table of the other;
external forces applied to theſe parts
ſtrongly reſiſted, becauſe the ſutures can
yield, unleſs the ſerrated edges of the
bone, and the plain internal plate of the o
are broken (*b*).

The advantages of the ſutures of the *cr*
um are theſe: 1. That this *capſula* is m
eaſily formed and extended into a ſpherical
gure, than if it had been one continued bo

2. T

(*a*) Hunauld, Memoires de l'acad des ſciences, 1730.
(*b*) Winſlow, Memoires de l'acad. des ſciences, 1720.

2. That the bones which are at ſome diſtance from each other at birth, might then yield, and allow to the head a change of ſhape, accommodated to the paſſage it is engaged in. Whence, in hard labour of child-bed, the bones of the *cranium*, inſtead of being only brought into contact, are ſometimes made to mount one upon the other. 3. It is alledged, that, thro' the ſutures, there is a tranſpiration of ſteams from the brain, which was the old doctrine; or ſome communication of the veſſels without, and of thoſe within the ſcull, larger here than in any other part of the *cranium*, according to ſome moderns; and therefore *cucupha*, *fomentations*, *cataplaſms*, *cephalic plaiſters*, *bliſters*, are applied, and *iſſues* are eroded, or cut in the head, at thoſe places where the ſutures are longeſt in forming, and where the connection of the bones is afterwards looſeſt, for the cure of a *phrenitis*, *mania*, *inveterate headach*, *epilepſy*, *apoplexy*, and other diſeaſes of the head. The favourers of the doctrine of tranſpiration, or communication of veſſels at the ſutures, endeavour to ſupport it by obſervations of perſons ſubject to head-achs which cauſed death, from the ſutures being too cloſely united (*a*). 4. That the *dura mater* may be more firmly ſuſpended by its proceſſes, which inſinuate themſelves into this conjunction of the bones; for doing this equally, and where the greateſt neceſſity of adheſion is, the ſutures are diſpoſed at nearly

equal

(*a*) Columb. de re anat. lib. 1. cap. 5.——Verduc. nouvelle oſteologie, chap. 14.——Dionis, Anat. 3. demonſtr. des os.

equal diſtances, and the large *reſervoirs* of blood, the *ſinuſes*, are under or near them. 5. That fractures might be prevented from reaching ſo far as they would in a continued bony ſubſtance. 6. That the connection at the ſutures being capable of yielding, the bones might be allowed to ſeparate; which has given great relief to patients from the violent ſymptoms which they had before this ſeparation happened (*a*). And it ſeems reaſonable to believe, that the opening of the ſutures was of great benefit to ſeveral others who were rather judged to have been hurt by it (*b*): for we muſt think, that the conſequences of ſuch a force acting upon the brain, as was capable of thruſting the bones aſunder, muſt have been fatal, unleſs it had been thus yielded to.

Having gone through the general ſtructure of the *cranium*, I now proceed to examine each bone of which that brain-caſe conſiſts, in the order in which I firſt named them.

The *OS FRONTIS* † has its name from its being the only bone of that part of the face we call the *forehead*, though it reaches a good deal further. Is has ſome reſemblance in ſhape to the ſhell of the *concha bivalvis*, commonly called

(*a*) Ephemerid. Germanic. dec. 1. ann. 4. et 5. obſerv. 33.

(*b*) Ephemerid. Germ. dec. 2. ann. 9. obſ. 230. Ibid. cent. 10. obſ. 31.—Vander Linden Medicin. phyſ. cap. 8. art. 4. § 16.—Hildan Obſerv. cent. 1. obſ. 1. cent. obſ. 7.—Bauhin. Theat. anat. lib. 3. cap. 6.—Pechlin. Obſerv lib. 2. obſerv. 39.

† Μετῶπον, Βρὲγμα, coronale, inverecundum, puppis, ſenſus communis, ſincipitis.

called the *cockle*; for the greateſt part of it is convex externally, and concave internally, with a ſerrated circular edge ; while the ſmaller part has proceſſes and depreſſions, which make it of an irregular figure.

The external ſurface of the *os frontis* is ſmooth at its upper convex part ; but ſeveral proceſſes and cavities are obſervable below : for, at each angle of each orbit, the bone jutts out, to form four proceſſes, two internal, and as many external ; which, from this ſituatio may well enough be named *angular*. Betwee the internal and external angular proceſſes o each ſide, an arched ridge is extended, o which the eye brows are placed.——Very littl above the internal end of each of theſe *ſuperciliary* ridges, a protuberance may be remarked, in moſt ſculls, where there are large cavities, called *ſinuſes*, within the bone ; of which hereafter.—Betwixt the internal angular proceſſes, a ſmall proceſs riſes, which forms ſome ſhare of the noſe, and thence is named *naſal*.——Some obſerve a protuberant part on the edge of the bone behind each external angular proceſs, which they call *temporal* proceſſes ; but theſe are inconſiderable.——From the under part of the ſuperciliary ridges, the frontal bone runs a great way backwards; which parts may juſtly enough be called *orbitar* proceſſes. Theſe, contrary to the reſt of this bone, are concave externally, for receiving the globes of the eyes, with their muſcles, fat, &c.

In each of the *orbitar* proceſſes, behind the middle of the ſuperciliary ridges, a conſiderable ſinuoſity is obſerved, where the *glandula* *innominata Galeni* or *lachrymalis* is lodged.—Behind each internal angular proceſs, a ſmall pit may be remarked, where the cartilaginous pully of the *muſculus obliquus major* of the eye is fixed.——Betwixt the two orbitar proceſſes, there is a large diſcontinuation of the bone, into which the cribriform part of the *os ethmoides* is incaſed.—The frontal bone frequently has little caverns formed in it here where it is joined to the ethmoid bone.——Behind each external angular proceſs, the ſurface of the frontal bone is conſiderably depreſſed where part of the *temporal* muſcle is placed.

The *foramina*, or holes, obſervable on the external ſurface of the frontal bone, are three in each ſide.——One in each ſuperciliary ridge, a little removed from its middle towards the noſe; through which a twig of the *ophthalmic* branch of the fifth pair of nerves paſſes out of the orbit, with a ſmall artery from the internal carotid, to be diſtributed to the teguments and muſcles of the forehead.—Theſe veſſels in ſome ſculls make furrows in the *os frontis*, eſpecially in the bones of children, as has alſo been obſerved of another conſiderable veſſel of this bone near its middle (*a*); and therefore we ought to beware of tranſverſe inciſions on either ſide of the *os frontis*, which migh either open theſe veſſels or hurt the nerves, while they are yet in part within the bone; for when veſſels are thus wounded, it is difficult to ſtop the hæmorrhagy, becauſe the adheſion of a part of the artery to the bone hinders its contraction

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(*a*) Ruyſch. Muſ. anat. theca D. repoſit. 4. No. 3.

contraction, and conſequently ſtyptics can have ittle effect; the ſides of the furrow keep off ompreſſing ſubſtances from the artery; and ve would wiſh to ſhun cauteries or eſcharotics, ecauſe they make the bone carious; and erves, when thus hurt, ſometimes produce iolent ſymptoms.—But, to return to the *ſu-erciliary foramina*, we muſt remark, that often, nſtead of a hole, a notch only is to be ſeen: Nay, in ſome ſculls, ſcarce a veſtige even of his is left; in others, both hole and notch re obſervable, when the nerve and artery run eparately. Frequently a hole is found on one ide, and a notch on the other; at other imes we ſee two holes; or there is a com-on hole without, and two diſtinct entries in-ernally. The reaſon of this variety of a hole, otch, depreſſion, or ſmoothneſs in the ſuper-iliary ridge, is the different length and ten-on of the nerves and veſſels; the ſhorter hey are, the more they are ſunk into the bone s it grows.—Near the middle of the inſide of ach orbit, hard by, or in the *tranſverſe ſu-re*, there is a ſmall hole for the paſſage of e naſal twig of the firſt branch of the fifth air of nerves, and of a branch of the oph-almic artery. This hole is ſometimes entire-formed in the *os frontis*; in other ſculls, the des of it are compoſed of this laſt bone, and the *os planum*. It is commonly known by e name of *orbitarium internum*, though *ante-us* ſhould be added, becauſe of the next, which commonly omitted.——This, which may be lled *orbitarium internum poſterius*, is ſuch an-her as the former; only ſmaller, and about an

inch

inch deeper in the orbit: through it a ſmall branch of the ocular artery paſſes to the noſe.——Beſides theſe ſix, there are a great number of ſmall holes obſervable on the outer ſurface of this bone, particularly in the two protuberances above the eye-brows. Moſt of theſe penetrate no further than the *ſinuſes*, or than the *diploe*, if the *ſinuſes* are wanting; though ſometimes I have ſeen this bone ſo perforated by a vaſt number of theſe ſmall holes, that, placed between the eye and a clear light, it appeared like a ſieve.——In the orbit of the generality of *ſkeletons*, we may obſerve one, two, or more holes, which allow a paſſage to a hog's briſtle through the ſcull. The place, ſize, and number of theſe, are however uncertain: They generally ſerve for the tranſmiſſion of ſmall arteries or nerves.

The internal ſurface of the *os frontis* is concave, except at the orbitar proceſſes, which ar convex, to ſupport the anterior lobes of th brain. This ſurface is not ſo ſmooth as the external; for the larger branches of the arteri of the *dura mater* make ſome furrows in it ſides and back parts. The ſinuoſities from th luxuriant riſings of the brain, mentioned whe deſcribing the general ſtructure of the *cranium* are often very obſervable on its upper part and its lower and fore parts are marked wi the contorſions of the anterior lobes of t brain.——Through the middle of this intern ſurface, where always in children, and ſom times in old people, the bone is divided, eith a ridge ſtands out, to which the upper ed of the *falx* is faſtened, or a furrow runs,

whi

ich the upper ſide of the ſuperior longitudi-
ſinus is lodged; on both theſe accounts chi-
gical authors juſtly diſcharge the applica-
n of the trepan here.—The reaſon of this
fference in ſculls, is alledged by ſome au-
ors to be this, That in thin ſculls the ridge
engthens the bones, and in thick ones there
no occaſion for it. To this way of account-
g for this phænomenon, it may juſtly be ob-
ſted, that generally very thick ſculls have a
ge ſpine here, and frequently thin ones have
ly a furrow. Perhaps this variety may be
ving to the different times of compleat oſ-
cation of thoſe parts in different ſubjects:
r if the two ſides of this bone meet before
ey arrive at their utmoſt extent of growth,
ey unite very firmly, and all their fibres en-
avour to ſtretch themſelves out where the
ſt reſiſtance is, that is, between the hemi-
heres of the brain. To ſupport this reaſon-
g, we may remark, that thoſe adults, whoſe
ntal bone is divided by the ſagittal ſuture,
ver have a ridge in this place.

Immediately at the root of this ridge or
row there is a ſmall hole, which ſometimes
rces through the firſt table, and, in other
lls, opens into the ſuperior *ſinus* of the *eth-*
id bone within the noſe. In it a little pro-
ſs of the *falx* is lodged, and a ſmall artery,
d ſometimes a vein, runs (*a*); and the ſupe-
r longitudinal *ſinus* begins here.—This hole,
wever, is often not entirely proper to the *os*
ntis; for in ſeveral ſculls, the lower part of
s formed in the upper part of the baſe of the
criſta

(*a*) Morgagn. Adverſar. 6. animad. 31.

criſta galli, which is a proceſs of the *ethmoi* bone (*a*).

The *os frontis* is compoſed of two table and an intermediate *diploe*, as the other bone of the *cranium* are, and, in a middle degre of thickneſs between the *os occipitis* and the *pa-rietal* bones; is pretty equally denſe all through except at the orbitar proceſſes, where, by th action of the eye on one ſide, and preſſure o the lobes of the brain on the other, it is mad extremely thin and diaphanous, and the *meditullium* is entirely obliterated. Since in thi place there is ſo weak a defence for the brai the reaſon appears why fencers eſteem a pu in the eye mortal (*b*).

The *diploe* is alſo exhauſted in that part a-bove the eye-brows, where the two tables o the bone ſeparate, by the external being protruded outwards, to form two large cavitie called *ſinus frontales.*—Theſe are divided by middle perpendicular bony partition——The capacities in the ſame ſubject are ſeldom equal in ſome the right, in others the left is largeſt.—And in different bones their ſize is as inconſtant; nay, I have examined ſome, where th were entirely wanting; which oftener happe in ſuch as have a flat fore-head, and whoſe ſ gittal ſuture is continued down to the noſ than in others (*c*).—In ſome ſculls, beſides th large perpendicular *ſeptum*, there are ſever bon

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(*a*) Ingraff. Comment. in Galen. de oſſib. cap. 1. comment. 8.

(*b*) Ruyſch. Obſerv. anat. chir. obſerv. 54.—Diemerbroeck. Anat. lib. 3. cap. 10.—Bonet. Sepulch. anat. lib. 4. ſ obſerv. 17.

(*c*) Fallop. Expoſit. de oſſibus, cap. 13.

ny pillars, or ſhort partitions, found in each us; in others theſe are wanting——For the ſt part the *ſeptum* is entire; at other times s diſcontinued, and the two *ſinuſes* commu- ate.—When the *ſinuſes* are ſeen in ſuch ſculls have the frontal bone divided by the ſagittal ure, the partition dividing theſe cavities is dently compoſed of two plates, which eaſily arate.——Each *ſinus* commonly opens by a ndiſh ſmall hole, at the inner and lower part the internal angular proceſſes, into a *ſinus* med in the noſe, at the upper and back part the *os unguis;* near to which there are alſo ne other ſmall *ſinuſes* of this bone (*a*), the ater part of which open ſeparately nearer *ſeptum narium*, and often they terminate in ſame common canal with the large ones.

n a natural and ſound ſtate, theſe cavities of conſiderable advantage; for the organ ſmelling being thus enlarged, the *effluvia* odorous bodies more difficultly eſcape it; their impreſſions being more numerous, are refore ſtronger, and affect the organ more. at odorous particles may be applied to the mbrane of the *ſinuſes*, is evident from the n felt in this part of the forehead, when the *uvia* of volatile ſpirits, or of ſtrong aroma- , are drawn up into the noſe by a quick piration.————Theſe and the other ca- es which open into the noſe, increaſe the nd of our voice, and render it more melo- us, by ſerving as ſo many vaults to reſound notes. Hence people labouring under a *yza*, or ſtoppage of the noſe from any o-

ther

) Cowper in Drake's Anthropolog book 3. chap. 10.

ther cauſe, when they are by the vulgar, thou falſely, ſaid to ſpeak through their noſe, ha ſuch a diſagreeable harſh voice.——The liqu ſeparated in the membrane of theſe ſinuſe drills down upon the membrane of the noſe keep it moiſt.

From the deſcription of theſe *ſinuſes*, it evident, how uſeleſs, nay, how pernicious muſt be, to apply a trepan on this part of ſcull; for this inſtrument, inſtead of pierci into the cavity of the *cranium*, would reach further than the *ſinuſes*; or, if the inner ta was perforated, any extravaſated blood happened to be within the ſcull, would not diſcharged outwardly, but would fall into *ſinuſes*, there to ſtagnate, corrupt, and ſti late the ſenſible membranes; from which there would be ſuch a conſtant flow of gl mucus, as would retard, if not hinder a c and would make the ſore degenerate into incurable *fiſtula*. Beſides, as it would be moſt impoſſible in this caſe to prevent the paſſing through the noſe, from having c ſtant acceſs to the *dura mater*, or brain; a corruption would be brought on theſe pa as would be attended with great danger. ther, in reſpiration, the air ruſhing viole into theſe cavities of the *os frontis*, and ſing through the external orifice, whenever was not well covered and defended, would only prevent the cloſing up of the external rifice, but might otherwiſe bring on bad c ſequences (*a*).——The membrane lining

ſin

(*a*) Paaw, de Oſſibus, pars. 1. cap. 7.——Palfyne Ana chir. traité 4. chap. 15. Nouvelle oſteologie, partie 2. chap.

ſes is ſo ſenſible, that inflammations of it ſt create violent torture (*a*) ; and worms, or er inſects crawling there, muſt give great aſineſs (*b*).

The upper circular part of the *os frontis*, is ed to the *oſſa parietalia*, from one temple he other, by the coronal ſuture. From the nination of the coronal ſuture to the ex- al angular proceſſes, this bone is connected he *ſphenoid* by the *ſphenoidal* ſuture. At external *canthi* of the eyes, its angular pro- es are joined by the tranſverſe ſuture to the *malarum*, to which it adheres one third n the outſide of the orbits ; whence to the om of theſe cavities, and a little up on r internal ſides, theſe orbitar proceſſes are nected to the *ſphenoidal* bone by that ſame re.—In ſome few ſculls, however, a diſ- inuation of theſe two bones appears at the er part of the long ſlit, near the bottom he orbit. — On the inſide of each orbit, orbitar proceſs is indented between the *cri- rm* part of the *ethmoid* bone, and the *os um* and *unguis.*——The tranſverſe ſuture af- ards joins the frontal bone to the ſuperior proceſſes of the *oſſa maxillaria ſuperiora*, to the naſal bones. And, *laſtly*, its naſal eſs is connected to the naſal *lamella* of the *oid* bone.

The

) Fernel. Bartholog. lib. 5. cap. 7.——Saltzman Decur. . 10.

Fernel. Partholog. lib. 5. cap. 7.——Bartholin. Epiſtol. . cent. 2. epiſt. 74.——Hiſt. de l'acad. des ſciences, & 1733.

The *frontal* bone ſerves to defend and ſ
port the anterior lobes of the brain. It for
a conſiderable part of the cavities that cont
the globes of the eyes, helps to make up
ſeptum narium, organ of ſmelling, *&c.* Fr
the deſcription of the ſeveral parts, the o
uſes of this bone are evident.

In a ripe child, the frontal bone is divi
through the middle; the ſuperciliary holes
not formed; often a ſmall round piece of
orbitar proceſs, behind the ſuperciliary ri
is not oſſified, and there is no *ſinus* to be
within its ſubſtance.

Each of the two *OSSA PARIETALI*
or bones ſerving as walls to the *enceph*
is an irregular ſquare; its upper and fore
being longer than the one behind or be
The inferior ſide is a concave arch; the
dle part receiving the upper round part of
temporal bone.—The angle formed by this
per ſide, and the fore one, is ſo extended,
have the appearance of a proceſs.

The external ſurface of each *os pariet*
convex. Upon it, ſomewhat below the m
heighth of the bone, there is a tranſverſe
ed ridge, of a whiter colour generally
any other part of the bone; from whic
bones that have ſtrong prints of muſcles
ſee a great many converging furrows, li
many *radii* drawn from a circumferen
wards a center. From this ridge of each
the temporal muſcle riſes; and, by the pr
of its fibres, occaſions the furrows juſt
menti

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[*] Κορυφῆς, paria, ſyncipitis, verticis, arcualia, nerv
gitationis, rationis, bregmatis, madefactionis.

entioned.——Below theſe, we obſerve, near
he ſemicircular edges, a great many riſings
nd depreſſions, which are joined to like ine-
ualities on the inſide of the temporal bone,
form the ſquamous ſuture. The temporal
one may therefore ſerve here as a buttreſs, to
revent the lower ſide of the parietal from
arting outwards when its upper part is preſſed
ſtruck (*a*).

Near the upper ſides of theſe bones, towards
e hind part, is a ſmall hole in each, through
hich a vein paſſes from the teguments of the
ad to the longitudinal *ſinus*. Sometimes I
ve ſeen a branch of the temporal artery
ſs through this hole, to be diſtributed to the
per part of the *falx*, and to the *dura ma-*
at its ſides, where it had frequent anaſto-
oſes with the branches of the arteries de-
ed from the external carotids, which com-
only have the name of the arteries of the
a mater, and with the branches of the in-
nal carotids which ſerve the *falx*.—In ſeve-
ſculls, one of the *oſſa parietalia* has not this
e; in others, there are two in one bone;
in ſome not one in either. Moſt frequent-
his hole is through both tables; at other
es the external table is only perforated.—
e knowledge of the courſe of theſe veſſels,
y be of uſe to ſurgeons, when they make
incision near this part of the head, leſt,
he veſſels are raſhly cut near the hole, they
nk within the ſubſtance of the bone, and
cauſe an obſtinate hæmorrhagy, which nei-
ligatures nor medicines can ſtop.

) Hunauld in Mem. de l'acad. des ſciences, 1730.

On the inner concave ſurface of the parietal bones, we ſee a great many deep furrows, diſpoſed ſomewhat like the branches of trees: The furrows are largeſt and deepeſt at the lower edge of each *os parietale*, eſpecially near its anterior angle, where ſometimes a full canal is formed. They afterwards divide into ſmall furrows, in their progreſs upwards.—In ſome ſculls a large furrow begins at the hole near the upper edge, and divides into branches, which join with thoſe which come upwards, ſhewing the communications of the upper and lower veſſels of the *dura mater*.—In theſe furrows we frequently ſee paſſages into the *diploe;* and ſometimes I have obſerved canals going off, which allowed a ſmall probe to paſs ſome inches into the bony ſubſtance. Some (*a*) tell us, that they have obſerved theſe canals piercing the bone towards the *occiput*.—On the inſide of the upper edge of the *oſſ* *parietalia*, there is a large ſinuoſity, frequently larger in the bone of one ſide than of the other, where the upper part of the *falx* is faſtened, and the ſuperior longitudinal *ſinus* i lodged.—Generally part of the lateral *ſinuſe* makes a depreſſion near the angle, formed b the lower and poſterior ſides of theſe bones; and the pits made by the prominent parts o the brain are to be ſeen in no part of the ſcu more frequent, or more conſiderable, than i the internal ſurface of the parietal bones.

The *oſſa parietalia* are amongſt the thinne bones of the *cranium;* but enjoy the gener

ſtructu

(a) Cowper. Anatom. explic. of 90. tab. fig. 2.

ſtructure of two tables and *diploe* the completeſt, and are the moſt equal and ſmooth.

Theſe bones are joined at their fore-ſide to the *os frontis* by the coronal ſuture; at their long inferior angles, to the *ſphenoid bone*, by part of the ſuture of this name; at their lower edge, to the *oſſa temporum*, by the ſquamous ſuture, and its poſterior *additamentum*; behind, to the *os occipitis*, or *oſſa triquetra*, by the lambdoid ſuture; and above, to one another, by the ſagittal ſuture.

They have no particular uſes beſides thoſe mentioned in the deſcription of their ſeveral parts, except what are included in the account of the general ſtructure of the *cranium*.

In a child born at the full time, none of the ſides of this bone are completed; and there ever is a hole in the oſſified part of it near to the ſagittal ſuture.

The large unoſſified ligamentous part of the *cranium* obſervable between the parietal bones, and the middle of the divided *os frontis* of new-born children, called by the vulgar the *open of the head*, was imagined by the antients to ſerve for the evacuation of the ſuperfluous moiſture of the brain; and therefore they named it *bregma* *, or the fountain; ſometimes adding the epiphet *pulſatilis*, or beating, on account of the pulſation of the brain felt through this flexible ligamento-cartilaginous ſubſtance. Hence very frequently the parietal bones are called *oſſa bregmatis*.

The upper middle part of the head of a child, in a natural birth, being what preſents itſelf

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* Palpitans vertex, foliolum, folium, triangularis lacuna.

itſelf firſt at the *os uteri* (*a*), an accoucheur may reach the *bregma* with his finger, when the *os uteri* is a little opened. If the *bregma* is ſtretched, and the pulſation of the brain is felt through it, the child is certainly alive: But if it is ſhrivelled and flaccid, without any obſervable pulſation in it, there is ſome reaſon to ſuſpect the child to be very weak, or dead. Thoſe who practiſe midwifery ſhould therefore examine the ſtate of the *bregma* accurately.

All the *bregma* is generally oſſified before ſeven years of age. Several authors (*b*) ſay, they have obſerved it unoſſified in adults; and phyſicians, who order the application of medicines at the meeting of the coronal and ſagittal ſutures, ſeem yet to think that a derivation of noxious humours from the *encephalon* is more eaſily procured at this part than any other of the ſcull; and that medicines have a greater effect here, than elſewhere, in the internal diſorders of the head.

OSSA TEMPORUM *, ſo named, ſay authors, from the hair's firſt becoming gray on the temples, and thus diſcovering peoples ages, are each of them equal and ſmooth above, with a very thin ſemicircular edge; which, from the manner of its connection with the neighbouring bones, is diſtinguiſhed by the name

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(*a*) Burton's Midwifery, § 51.—— Smellie's Midwifery, book 1. chap. 1. § 5.

(*b*) Bartholin. Anat. reform. lib. 4. cap. 6. ——Diemerbroek, Anat lib. 9. cap. 6. —— Kerkring. Oſteogen. cap. 2.

* Κόρταφῶν, κορσῶν, κοῤῥων, λεπιδοειδῆ, πολυειδῆ, λιθοειδῆ, temporalia, lapidoſa, mendoſa, dura, arcualia, tymparum, armalia, ſaxea, parietalia.

ame of *os ſquamoſum*.——Behind this, the up-
r part of the temporal bone is thicker, and
ore unequal, and is ſometimes deſcribed as a
ſtinct part, under the name of *pars mammil-
ris* (*a*).——Towards the baſe of the ſcull, the
mporal bone appears very irregular and une-
al; and this part, inſtead of being broad,
d placed perpendicularly, as the others are, is
ntracted into an oblong very hard ſubſtance,
tended horizontally forwards and inwards,
hich in its progreſs becomes ſmaller, and is
mmonly called *os petroſum*.

Three external proceſſes of each temporal
ne are generally deſcribed—The firſt placed
the lower and hind part of the bone, from
reſemblance to a nipple, is called *maſtoides*,
mammillaris. It is not ſolid, but within is
mpoſed of *cancelli*, or ſmall cells, which
ve a communication with the large cavity of
e ear, the drum; and therefore ſounds, be-
g multiplied in this vaulted labyrinth, are in-
eaſed, before they are applied to the imme-
ate organ of hearing. Into the maſtoid pro-
ſs, the *ſtenomaſtoideus* muſcle is inſerted;
d to its back part, where the ſurface is rough,
trachelomaſtoideus, and part of the *ſplenius*
fixed.—About an inch farther forward, the
ond proceſs begins to riſe out from the bone;
d having its origin continued obliquely down-
rds and forwards for ſome way, it becomes
aller, and is ſtretched forwards to join with
os malæ; they together forming the bony
um, under which the temporal muſcle paſſes.

(*a*) Albin. de oſſib. § 26.

Hence this proceſs has been named *zygomatic*.* Its upper edge has the ſtrong aponeuroſis of the *temporal* muſcle fixed into it; and its lower part gives riſe to a ſhare of the *maſſeter*.— The fore-part of the baſe of this proceſs is an oblong tubercle, which in a recent ſubject is covered with a ſmooth poliſhed cartilage, continued from that which lines the cavity immediately behind this tubercle.———from the under craggy part of the *os temporum*, the third proceſs ſtands out obliquely forwards. The ſhape of it is generally ſaid to reſemble the ancient *ſtylus ſcriptorius*; and therefore i is called the *ſtyloid* proceſs †. Some authors (a) however contend, that it ought to be named *ſteloid*, from its being more like to a pillar. Several muſcles have their origin from this proceſs, and borrow one half of their name from it; as *ſtylo-gloſſus*, *ſtylo-hyoideus*, *ſtyl* *pharyngeus*; to it a ligament of the *os hyoid* is ſometimes fixed; and another is extend from it to the inſide of the angle of the lo er jaw. This proceſs is often even in adul not entirely oſſified, but is ligamentous at i root, and ſometimes is compoſed of two three diſtinct pieces.——Round the root of eſpecially at the fore-part, there is a remar able riſing of the *os petroſum*, which so have eſteemed a proceſs; and, from the pearan

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[*] Καγχρος, paris, anſæ oſſium temporum, oſſa arcualia, ria, jugalia, conjugalia.

[†] Γραιφοειδη, βελονοειδῆ, πληκτρὸν, os calaminum, ſagi clavale, acuale, calcar capitis.

(a) Galen, de uſu part. lib. 2. cap. 4 ——Fallop. Ob anatom.

rance it makes with the *ſtyliform*, have na-
d it *vaginalis*.——Others again have, under
name of *auditory* proceſs, reckoned among
external proceſſes that ſemicircular ridge,
ich, running between the root of the *ma-*
d and *zygomatic* proceſſes, forms the under-
t of the external *meatus auditorius*.

The ſinuoſities or depreſſions on the exter-
ſurface of each *os temporum* are theſe:
—A long *foſſa* at the inner and back part of
root of the mammary proceſs, where the
ſterior head of the *digaſtric* muſcle has its o-
in.—Immediately before the root of the
omatic proceſs, a conſiderable hollow is left,
lodging the *crotaphite* muſcle.——Between
zygomatic, *auditory*, and *vaginal* proceſſes,
large cavity is formed; through the middle
which, from top to bottom, a fiſſure
obſervable, into which part of the liga-
nt that ſecures the articulation of the lower
with this bone is fixed. The fore part of
cavity being lined with the ſame car-
ge which covers the tubercle before it, re-
ves the *condyle* of the jaw; and in the back-
t a ſmall ſhare of the parotid gland, and a
lular fatty ſubſtance, are lodged.—At the in-
e of the root of the *ſtyloid apophyſe*, there is
himble-like cavity, where the beginning of
internal jugular vein, or end of the lateral
us is lodged.—And as the ſinuſes of the two
es are frequently of unequal ſize; ſo one of
ſe cavities is as often larger than the other (*a*).
—Round the external *meatus auditorius*, ſeve-
ſinuoſities are formed for receiving the car-
tilages

(*a*) Hunauld. In Mem. de l'acad. des ſciences, 1730.

tilages and ligaments of the ear, and for thei
firm adheſion.

The *holes* that commonly appear on th
outſide of each of theſe bones, and are prop
to each of them, are five.——The *firſt*, ſituate
between the *zygomatic* and *maſtoid* proceſſe
is the orifice of a large funnel-like cana
which leads to the organ of hearing; there
fore is called *meatus auditorius externus* *.—
The *ſecond* gives paſſage to the *portia dura* o
the ſeventh pair of nerves, and from its ſituatio
between the *maſtoid* and *ſtyloid* proceſſes, i
called *foramen ſtylo-maſtoideum* †.—Some wa
before, and to the inſide of the *ſtyloid* proceſs, i
the *third* hole; the canal from which runs fir
upwards, then forwards, and receives into i
the internal *carotid* artery, and the beginni
of the intercoſtal nerve; where this canal is a
bout to make the turn forwards, one, or ſome
times two very ſmall holes go off towards th
cavity of the ear called *tympanum*: throug
theſe *Valſalva* (*a*) affirms the proper artery o
arteries of that cavity are ſent.—On the ante
rior edge of this bone, near the former, a *fourt*
hole is obſervable, being the orifice of a can
which runs outwards and backwards, in a hor
zontal direction, till it terminates in the *ty*
panum. This, in the recent ſubject, is cont
nued forward and inward, from the parts whic
I mentioned juſt now as its orifice in the ſk
leton, to the ſide of the noſtrils; being par
ly cartilaginous, and partly ligamentous. Th

who

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[*] Πόρος της ακοὴς, οπὴ τῶν ὠτῶν, feneſtra aurium.

[†] Aquaeductus Fallopii.

(*a*) De aure humana, cap. 2. § 22. et tab. 7. fig. 1.

ble canal is named, *Iter a palato ad aurem*, or
achian tube.—On the external ſide of the
y part of this canal, and a top of the chink
he cavity that receives the *condyle* of the
er jaw, is the courſe of the little nerve
commonly to be reflected from the lingual
ch of the fifth pair, till it enters the *tym-*
m, to run acroſs this cavity, and to have
name of *chorda tympani*.——The *fifth* hole
ry uncertain, appearing ſometimes behind
maſtoid proceſs; ſometimes it is common
e temporal and occipital bones; and in
al ſculls there is no ſuch hole. The
f it, when found, is for the tranſmiſſion
vein from the external teguments to the
al *ſinus*: But, in ſome ſubjects a branch
e occipital artery paſſes through this hole,
rve the back part of the *dura mater*; in
s, I have ſeen two or three ſuch holes:
hey are oftener wanting than found. And
ay, once for all, in general remark, That
argeneſs, number, ſituation, and exiſt-
of all ſuch holes, that for the moſt part
only a paſſage for veins from without to
nternal receptacles, are very uncertain.

e internal ſurface of the *oſſa temporum* is
ual; the upper circular edge of the ſqua-
part having numerous ſmall ridges and
ws for its conjunction with the parietal
s; and the reſt of it is irregularly marked
the convolutions of the middle part of the
, and with furrows made by the branches
e arteries of the *dura mater*.

om the under part of this internal ſurface,
ger tranſverſe hard craggy protuberance

runs horizontally inwards and forwards, wit
ſharp edge above, and two flat ſides, one
cing obliquely forwards and outwards, and
other as much backwards and inwards. To
ridge between theſe two ſides, the large l
ral proceſs of the *dura mater* is fixed.

Sometimes a ſmall bone, a-kin to the ſe
moid, is found between the ſmall end of
petrous proceſs and the *ſphenoid* bone (*a*).

Towards the back-part of the inſide of
os temporum, a large deep *foſſa* is conſpicu
where the *lateral ſinus* lies; and frequently
the top of the *petrous* ridge, a furrow may
obſerved, where a ſmall ſinus is ſituated.

The internal proper *foramina* of each
theſe bones are, *firſt*, the internal *meatus*
ditorius in the poſterior plain ſide of the
trous proceſs. This hole ſoon divides into t
one of which is the beginning of the *aqua*
of *Fallopius*; the other ends in ſeveral
ſmall canals (*b*) that allow a paſſage to
branches of the *portio mollis* of the ſeve
pair of nerves, into the *veſtibule* and *coc*
Through it alſo an artery is ſent, to be di
buted to the organ of hearing.——The *ſe*
hole, which is on the anterior plain ſide
the craggy proceſs, gives paſſage to a refle
branch of the ſecond branch of the fifth pa
nerves, which joins the *portio dura* of the
ditory nerve, while it is in the *aquæduct*

(*a*) Riolan. Comment. de oſſib. cap. 32.——Wi
Expoſition anatomique de corps humain, trait. des os
§ 266.

(*b*) Valſalv. De aure humana, cap. 3. § 11.

(*c*) Valſalv. De aure, cap. 3. § 10.

ll branches of blood veſſels accompanying nerves or paſſing through ſmaller holes this one.—The paſſage of the cutaneous into the lateral *ſinus*, or of a branch of occipital artery, is ſeen about the middle he large *foſſa* for that *ſinus* ; and the ori- of the canal of the *carotid* artery is evi- at the under part of the point of the *pe-* proceſs.

eſides theſe proper holes of the temporal es which appear on their external and inter- ſurfaces, there are two others in each ſide are common to this bone and to the *occi-* and *ſphenoidal* bones ; which ſhall be men- ed afterwards in the deſcription of theſe s.

he upper round part of the ſquamous bones in, but equal ; while the low petrous part ick and ſtrong, but irregular and unequal, ng the diſtinction of tables and *diploe* ounded, with ſeveral cavities, proceſſes, bones within its ſubſtance, which are parts e organ of hearing. That a clear idea be had of this beautiful, but intricate or- anatomiſts generally chuſe to demonſtrate s parts together. I think the method ; and therefore, ſince it would be impro- o inſert a compleat treatiſe on the ear ſhall omit the deſcription of the parts ined within the *os petroſum* of the ſkele-

he temporal bones are joined above to the tal bones by the ſquamous ſutures, and poſterior *additamenta*: Before, to the *ſphe-* one by the ſuture of that name; to the cheek-bones by the *zygomatic* ſutures : Behin to the *occipital* bone, by the *lambdoid* ſutu and its *additamenta ;* and they are articulate with the *lower jaw* in the manner which ſh be deſcribed when this bone is examined.

The purpoſes which theſe two bones ſer are eaſily collected, from the general uſe of t *cranium*, and from what has been ſaid in t deſcription of their ſeveral parts.

In an infant, a ſmall fiſſure is to be obſe ved between the thin upper part, and the low craggy part of each of theſe bones ; whi points out the recent union of theſe parts.— Neither *maſtoid* nor *ſtyloid* proceſſes are yet be ſeen.—Inſtead of a bony funnel-like ext nal *meatus auditorius*, there is only a ſmo bony ring, within which the membrane of drum is faſtened.——At the entry of the *ſtachian tube*, the ſide of the *tympanum* is completed.——A little more outward than internal auditory canal, there is a deep pit, ver the upper part of whoſe orifice the inter ſemicircular canal of the ear is ſtretched; ſome way below this, the poſterior ſemicir lar canal alſo appears manifeſtly.

OS OCCIPITIS *, ſo called from its ſit tion, is convex on the outſide, and concave ternally. Its figure is an irregular ſquare, rather *rhomboid ;* of which the angle above generally a little rounded ; the two lateral gles are more finiſhed, but obtuſe ; and lower one is ſtretched forward in form of wedge, and thence is called by ſome the *cu*

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* Ἰνίον, baſilare, proræ, memoriæ, pixidis, fibroſum, n ſum, lambde.

orm proceſs.——If one would, however, be very
ice in obſerving the ſeveral turns which the
dges of the *os occipitis* make, five or ſeven
des and as many angles of this bone might
e deſcribed.

The external ſurface is convex, except at
he cuneiform apophyſe, where it is flatted. At
he baſe of this triangular proceſs, on each ſide
f the great hole, but more advanced forwards
han the middle of it, the large oblong protu-
erances, named the *condyles*, appear, to ſerve
or the articulation of this bone with the
rſt *vertebra* of the neck. The ſmooth ſurface
f each of theſe *condyloid* proceſſes is longeſt
om behind forwards, where, by their oblique
uation, they come much nearer to each o-
her than they are at their back-part. Their
ner ſides are lower than the external, by
hich they are prevented from ſliding to either
de out of the cavities of the firſt *vertebra* (*a*).
ſome ſubjects each of theſe plain ſmooth
rfaces ſeems to be divided by a ſmall riſing
its middle; and the lower edge of each
ndyle, next the great *foramen*, is diſconti-
ued about the middle, by an interveening
tch: Whence ſome (*b*) alledge, that each of
eſe *apophyſes* is made up of two protuberan-
s.—Round their root a ſmall depreſſion and
ongy roughneſs is obſervable, where the li-
ments for ſurrounding and ſecuring their ar-
ulations adhere.——Though the motion of the
ad is performed on the condyles, yet the
nter of gravity of that globe does not fall

(*a*) Galen. de uſu part lib. 12. cap. 7.
(*b*) Diemerbroeck, Anat. lib. 9. cap. 6.

between them, but is a good way further fo
ward; from which mechaniſm it is evident
that the muſcles which pull the head back
muſt be in a conſtant ſtate of contraction
which is ſtronger than the natural contractio
of the proper flexors, elſe the head would a
ways fall forwards, as it does when a man is
ſleep, or labours under a palſy, as well as in i
fants, where the weight of the head far e
ceeds the proportional ſtrength of theſe mu
cles. This ſeeming diſadvantageous ſituatio
of the condyles is however of good uſe to
by allowing ſufficient ſpace for the cavities
the mouth and *fauces*, and for lodging a ſuf
cient number of muſcles, which commonly ſer
for other uſes; but may at pleaſure be direc
ed to act on the head, and then have an a
vantageous lever to act with, ſo as to be ab
to ſuſtain a conſiderable weight appended,
other force applied, to pull the head back.

Somewhat more externally than the *condy*
there is a ſmall riſing and ſemilunated hollo
in each ſide, which make part of the hol
common to the *occipital* and *petrous* bones.—I
mediately behind this, on each ſide, a ſcabro
ridge is extended from the middle of the co
dyle, towards the root of the *maſtoid* proc
Into this ridge the *muſculus lateralis*, commo
ly aſcribed to *Fallopius*, is inſerted.—About
middle of the external convex ſurface, a lar
arch runs croſs the bone; from the upper la
ral parts of which the *occipital* muſcles ha
their riſe; to its middle the *trapezii* are
tached; and half way between this and
great hole, a leſſer arch is extended.——In

hollo

ollows between the middle of theſe arches
e *complexi* are inſerted ; and in the depreſſi-
s more external and further forward than
eſe, the *ſplenii* are inſerted.—Between the
iddle of the leſſer arch and the great hole,
e little hollow marks of the *recti minores* ap-
ar; and on each ſide of theſe the fleſhly in-
tions of the *obliqui ſuperiores* and *recti majo-*
r make depreſſions.—Through the middle of
e two arches a ſmall ſharp *ſpine* is placed,
hich ſerves as ſome ſort of partition between
e muſcles of different ſides, or rather is ow-
g to the action of the muſcles depreſſing the
ne on each ſide of it, while this part is free
m their compreſſion.—Theſe prints of the
ſcles on this bone are very ſtrong and plain
ſome ſubjects, but are not ſo diſtinct in o-
rs.—All round the great *foramen* the edges
unequal, for the firmer adheſion of the
ng circular ligament which goes thence to
firſt *vertebra*.—One end of each *lateral* or
derator ligament of the head, is fixed to a
gh ſurface at the fore-part of each condyle,
d the *perpendicular* one is connected to a rough
t of the edge of the great hole between the
o condyles.—Immediately before the con-
les, two little depreſſions are made in the ex-
nal ſurface of the cuneiform proceſs, for the
ertion of the *recti anteriores minores* muſcles,
ich are unjuſtly aſcribed to *Cowper*: and ſtill
ther forward, near the *ſphenoid* bone, are
o other ſuch depreſſions, for the reception
the *recti anteriores majores*.—When we con-
r the ſize of the prints of muſcles on the

occipital bone, before and behind its condyles, and at the ſame time, compare their diſtances from theſe centers of motion of the head, we muſt ſee how much ſtronger the muſcles are which pull the head backwards, than thoſe are which bend it forward; and how much greater force the former acquire by the long lever they act with, than the latter which are inſerted ſo near the condyles. This great force in the extenſor muſcles is altogether neceſſary, that they might not only keep the head from falling forward in an erect poſture, but that they might ſupport it when we bow forward in the moſt neceſſary offices of ſocial life, when the weight of the head comes to act at right angles on the *vertebræ* of the neck, and obtains a long lever to act with.

On the inner ſurface of the *os occipitis* we ſee two ridges; one ſtanding perpendicular, the other running horizontally acroſs the firſt. The upper part of the perpendicular limb of the croſs, to which the *falx* is fixed, is hollowed in the middle, or often on one ſide, for the reception of the *ſuperior longitudinal ſinus*, and the lower part of it has the ſmall or third proceſs of the *dura mater* faſtened to it, and is ſometimes hollowed by the *occipital ſinus*. Each ſide of the horizontal limb is made hollow by the lateral ſinuſes incloſed in the tranſverſe proceſs of the *dura mater*; the *foſſa* in the right ſide being generally a continuation of the one made by the longitudinal ſinus in the perpendicular limb, and therefore is larger than the left one (*a*).——Round the middle of the croſs

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(*a*) Morgagn. Adverſ. anat. 6. animad. 1.

oſs there are four large depreſſions ſepara-
d by its limbs; the two upper ones being
rmed by the back-part of the brain, and the
o lower ones by the *cerebellum*.——Farther
rward than the laſt mentioned depreſſions, is
e lower part of the *foſſa* for the lateral *ſinus*
each ſide.———The inner ſurface of the cu-
iform apophyſe is made concave for the re-
ption of the *medulla oblongata*, and of the
ſilar artery.—A furrow is made on each ſide,
ar the edges of this proceſs, by a *ſinus* of
e *dura mater*, which empties itſelf into the
eral *ſinus* (*b*).

The holes of this bone are commonly five
oper, and two common to it and to the *tem-*
ral bones.—The firſt of the proper holes,
lled *foramen magnum* * from its ſize, is im-
ediately behind the wedge-like proceſs, and
ows a paſſage to the *medulla oblongata*, *ner-*
acceſſorii, to the vertebral arteries, and ſome-
nes to the vertebral veins.——At each
e of this great hole, near its fore-part, and
mediately above the condyles, we always
d a hole, ſometimes two, which ſoon unite
ain into one that opens externally; thro' theſe
ninth pair of nerves go out of the ſcull.—
e fourth and fifth holes pierce from behind
condyle of each ſide into the *foſſæ* of the
eral *ſinuſes*; they ſerve for the paſſage of
cervical veins to theſe *ſinuſes*. Often one
theſe holes is wanting, ſometimes both,
en the veins paſs thro' the great *foramen*.——
ſides theſe five, we frequently meet with o-
r holes near the edges of this bone, for the

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b) Albin. de oſſib. § 65.

Rachitidis, Medulæ ſpinalis.

tranſmiſſion of veins; but their number and diameter are very uncertain. The two common *foramina* are the large irregular holes, one in each ſide, between the ſides of the *cuneiform* proceſs, and the edges of the *petrou* bones. In a recent ſubject, a ſtrong membran runs croſs from one ſide to the other of eac of theſe holes; in ſome heads I have ſeen thi membrane oſſified, or a bony partition dividin each hole; and, in the greater number of adult ſculls, there is a ſmall ſharp-pointed proceſs ſtands out from the *os petroſum*, and more obtuſe riſing in the occipital bone, between which the partition is ſtretched. Behin this partition, where the largeſt ſpace is lef the *lateral ſinus* has its paſſage; and before the eighth pair of nerves and *acceſſorius* mak their exit out of the ſcull; and ſome author ſay, an artery paſſes through this hole, to b ſtowed on the *dura mater*.

The *occipital* bone is among the thickeſt the *cranium*, though unequally ſo; for it ſtronger above, where it has no other defen than the common teguments, than it is belo where being preſſed by the lobes of the bra and *cerebellum* on one ſide, and by the acti of the muſcles on the other, it is ſo very thi as to be diaphanous in many ſculls: But th theſe muſcles ward off injuries, and the ridg and ſpines, which are frequent here, make ſufficiently ſtrong to reſiſt ordinary forc The tables and *diploe* are tolerably diſtinct this bone, except where it is ſo thin as to b come diaphanous.

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The occipital bone is joined above to the *oſ-*
arietalia and *triquetra* when preſent, by the
bdoid ſuture ;———laterally to the tempo-
bones, by the *additamenta* of the *lambdoid*
ure ;——below to the *ſphenoid* bone, by the
of its cuneiform proceſs, in the ſame way
epiphyſes and their bones are joined : For
children a ligamentous cartilage is inter-
ed between the occipital and ſphenoid bones,
ich gradually turns thinner, as each of the
es advances, till their fibres at laſt run in-
ach other ; and, about ſixteen or eighteen
rs of age, the union of theſe two bones
omes ſo intimate, that a ſeparation cannot
made without violence.———The *os occipitis*
oined by a double articulation to the firſt
tebra of the neck, each condyle being re-
ved into a ſuperior oblique proceſs of that
tebra. What motion is allowed here, we
l conſider afterwards, where the *vertebræ*
deſcribed.

The uſes of this bone appear from the pre-
ding deſcription, and therefore need not be
eated.

An infant born at the full time, has this
e divided, by unoſſified cartilages, into four
ts.———The firſt of theſe is larger than the
er three, is of a triangular ſhape, and con-
utes all the part of the bone above the
at *foramen*. Generally fiſſures appear in
upper part and ſides of this triangular bone,
en all the cartilage is ſeparated by macera-
n ; and ſometimes little diſtinct bones are
n towards the edges of it.—The ſecond and
rd pieces of this bone are exactly alike, and
ſituated

ſituated on each ſide of the great *foramen* from which very near the whole condyles ar produced; and they are extended forwards al moſt to the fore-part of the hole for the ninth pair of nerves.——The fourth piece is the cu neiform proceſs, which forms a ſmall ſhare o the great hole, and of theſe for the ninth pai of nerves, and of the condyles: betwixt and the *ſphenoid* bone, a cartilage is interpoſed

Of the eight bones which belong to the *cra nium*, there are only two which are not yet de ſcribed, *viz.* the *ethmoid* and *ſphenoid.* Theſ we already mentioned, in complaiſance to th generality of writers on this ſubject, as bone common to the *cranium* and face, becauſe the enter into the compoſition of both: but th ſame reaſon might equally be uſed for callin the frontal bone a common one too. I ſhal however, paſs any idle diſpute about the pr priety of ranging them, and proceed to ex mine the ſtructure of the bones themſelves.

OS ETHMOIDES *, or the ſieve li bone, has got its name from the great num ber of ſmall holes with which that part of firſt taken notice of is pierced. When th bone is entire, the figure of it is not eaſily d ſcribed; but, by a detail of its ſeveral part ſome idea may be afforded of the whole; an therefore I ſhall diſtinguiſh it into the *cribr form lamella* with its proceſs, the *naſal lame la, cellulæ*, and *oſſa ſpongioſa.*

The thin horizontal *lamella*, is all (excep its back part) pierced obliquely by a great num ber of ſmall holes, through which the fil men

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* Cribriforme, σπογγοειδὴς, ſpongiforme, criſtatum.

nts of the olfactory nerves paſs. In a recent
ject, theſe holes are ſo cloſely lined by the
a mater, that they are much leſs conſpicu-
than in the *ſkeleton*.———From the middle
the internal ſide of this plate, a thick pro-
s riſes upwards, and, being higheſt at the
e-part, gradually becomes lower, as it is
ended backwards. From ſome reſemblance
ch this proceſs was imagined to have to a
k's comb, it has been called *criſta galli* *,
e *falx* is connected to its ridge, and to the
erforated part of the cribriform plate.——
en the *criſta* is broke, its baſe is ſometimes
nd to be hollow, with its cavity opening in-
he noſe (*a*).——Immediately before the
eſt part of this proceſs, is the blind hole
he *frontal* bone, which as was formerly
arked, is often in a good meaſure formed
notch in the fore-part of the root of the
a.

rom the middle of the outer ſurface of the
riform lamella, a thin ſolid plate is extend-
ownwards and forwards, having the ſame
mon baſe with the *criſta galli*. Generally it
ot exactly perpendicular, but is inclined to
ſide or other, and therefore divides the ca-
of the noſe unequally. Its inclination to
ſide, and flexure in the middle, is ſome-
s ſo great, that it fills up a large ſhare of
of the noſtrils, and has been miſtook for
ypus there.—It is thin at its riſe, and ra-
ſtill thinner in its middle; yet afterwards,
rds its lower edge, it becomes thicker,
that

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erruca praedura, ſeptum oſſis ſpongioſi.'

a) Palfyn. Anat. chir. tr 4. chap. 44.

that its conjunction with the bones and middl cartilage of the noſe might be firmer.

At a little diſtance from each ſide of thi external proceſs, a cellular and ſpongy bon ſubſtance depends from the cribriform plat The number and figure of the cells in this i regular proceſs of each ſide, are very unce tain, and not to be repreſented in words; o ly the cells open into each other, and into th cavity of the noſe: The uppermoſt, which a below the aperture of the frontal *ſinuſes*, a formed like funnels.——The outer ſurface theſe cells is ſmooth and plain, where this bo aſſiſts in compoſing the orbit; at which pla on each ſide, it has got the name of *os p* *num*; on the upper edge of which, a ſma notch or two may ſometimes be obſerv which go to the formation of the internal bitar holes; as was remarked in the deſcripti of the frontal bone.

Below the cells of each ſide, a thin plate extended inwards, and then bending down, becomes thick and of a ſpongy texture.— This ſpongy part is triangular, with a ſtreig upper edge placed horizontally, an anterior o ſlanting from above, downwards and forwar and with a pendulous convex one below.—T upper and lower edges terminate in a ſha point behind.—The ſide of this pendulous ſpo gy part next to the *ſeptum narium* is conv and its external ſide is concave.———Theſe t proceſſes of the *ethmoid* bone have got name of *oſſa ſpongioſa*, or *turbinata ſuperio* from their ſubſtance, figure, and ſituation.

ll the prominences, cavities and *meanders* this *ethmoid* bone, are covered with a conation of the membrane of the noſtrils, in ecent ſubject.——Its horizontal cribriform e is lodged between the orbitar proceſſes of *frontal* bone, to which it is joined by the *noid* ſuture, except at the back-part where connected with the *cuneiform* bone, by a re common to both theſe bones, though generally eſteemed part of the *ſphenoi*. ———Where the *oſſa plana* are contiguous the frontal bone within the orbit, their junction is reckoned part of the tranſverſe re.———Farther forward than the *oſſa plana*, cells are covered by the *oſſa unguis*, which not only contiguous to theſe cells, but canbe ſeparated from them, without breaking bony ſubſtance; and therefore, in juſtice, e bones ought to be demonſtrated as part he *ethmoid* bone.——Below the *oſſa unguis plana*, theſe cells and *oſſa ſpongioſa* are oopped by the *maxillary* bones.——The cel- part of each *palate* bone is contiguous ach *os planum* and cells backwards.—The er edge of the naſal perpendicular plate is ived into the furrow of the *vomer*.———Its eiior edge is joined to the fore-part of *proceſſus azygos* of the *ſphenoid* bone.——— ipper edge joins the *naſal* proceſs of the *tal* and *naſal* bones, and its anterior one is nected to the middle cartilage of the noſe.

rom all which, the uſes of this bone are ent, *viz.* to ſuſtain the anterior lobes of the n; to give paſſage to the olfactory nerves, attachment to the *falx*; to enlarge the

organ of ſmelling, by allowing the membr
of the noſe a great extent; to ſtraiten the p
ſage of the air through the noſe, by leavi
only a narrow winding canal, on the ſenſi
membranous ſides of which the ſubſtances co
veyed along with the air muſt ſtrike; to fo
part of the orbit of the eyes and *ſeptum*
rium; while all its parts are ſo light as not
be in hazard of ſeparating by their weig
and they are ſo thin, as to form a large ſurfa
without occupying much ſpace. This bri
ſubſtance, however, is ſufficiently prote
from external injuries by the firm bones wh
cover it.

If this bone is ſeized on by any corro
matter, we may eaſily conceive what deſtr
tion may enſue. Hence it is, that an *ozaen*
difficult to cure; and that, in violent *ſcur*
or in the *lues venerea*, the fabric of the n
the eyes, and life itſelf are in danger.—
ſituation of the naſal plate may ſhew us, h
dangerous a fracture of the bones of the n
may be, when made by a force applied to t
middle fore-part, of a perſon in whom this
ſal plate is perpendicular.

The *ethmoid* bone of ripe children is d
ded into two, by a perpendicular cartilage, wh
when oſſified, is the *criſta galli*, and n
plate: but its other parts are oſſified and c
plete.

OS SPHENOIDES [*], or wedge-
bone, ſo called becauſe of it ſituation in
mi

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[*] Cuneiforme, πολυμορφον, multiforme, paxillum, cribr
palati, colatorii, cavilla, baſilare.

niddle of the bones of the *cranium* and face,
s of ſuch an irregular, figure, that I know not
ny thing to which it may be likened, unleſs,
erhaps, it bear ſome faint reſemblance to a
at with its wings extended.

Vhen we view the external ſurface of the
s ſphenoides, two or three remarkable pro-
eſſes from each ſide of it may be obſerved,
hich are all of them again ſubdivided.——The
rſt pair is the two large lateral proceſſes or
ings; the upper part of each of which is
lled the *temporal proceſs*, becauſe they join
ith the temporal bones in forming the
mples, and the ſeat for ſome ſhare of the
otaphite muſcles. That part of the wings
hich jutts out towards the inſide, ſomewhat
wer than the temporal *apophyſes*, and is ſmooth
d hallowed, where it makes up part of the
bit, is thence named *orbitar proceſſes*. Be-
nd the edge, ſeparating theſe two proceſſes,
ere is often a ſmall groove, made by a branch
the ſuperior maxillary nerve, in its paſſage
the temporal muſcle. The loweſt and back
rt of each wing, which runs out ſharp to
eet the *oſſa petroſa*, has been ſtyled the *ſpi-*
us proceſs: From near the point of which a
arp pointed proceſs is frequently produced
wnwards, which ſome call *ſtyliform*, that af-
rds origin to the *ptery-ſtaphylinus exter-*
s muſcle. From this ſtyloid proceſs a very
all groove is extended along the edge of
e bone to the hollow at the root of the in-
nal plate of the following proceſſes, which

forms part of the *Euſtachian* tube (*a*).—The ſecond pair of external proceſſes of the *cuneiform* bone is the two which ſtand out almoſt perpendicular to the baſe of the ſcull. Each of them has two plates, and a middle *foſſa* facing backwards, and ſhould, to carry on our compariſon, be likened to the bat's legs; but are commonly ſaid to reſemble the wings of that creature; and therefore are named *pterygoid* or *aliform* * proceſſes. The external plates are broadeſt, and the internal are longeſt. From each ſide of the external plates the *pterygoid* muſcles take their riſe. At the root of each internal plate, a ſmall hollow may be remarked, where the *muſculus ptery-ſtaphylinus internus*, or *circumflexus palati* riſes, and ſome ſhare of the cartilaginous end of the *Euſtachian* tube reſts; and, at the lower end of the ſame plate, is a hook-like riſing or proceſs, round which the tendon of the laſt named muſcle plays, as on a pulley. From the edge of the external plates ſome ſmall ſharp ſpikes ſtand out; but their number and bulk are uncertain.——To theſe another pair may be added, to wit, the little triangular thin proceſs which comes from each ſide of the body of the *ſphenoid* bone, where the *pterygoid* proceſſes are riſing from it, and are extended over the lower part of the aperture of the *ſinus* as far as to join the *ethmoid* bone, while their body hangs

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(*a*) Winſlow, Expoſition anatomique du corps humain, tra des os ſecs, § 233.

* Naviculares.

angs down into the *nares* (*a*). — Beſides theſe
airs of proceſſes, there is a ſharp ridge which
ands out from the middle of its baſe: Becauſe
wants a fellow, it may be called *proceſſus*
zygos. The lower part of this proceſs, where
is received into the *vomer*, is thick, and often
ot quite perpendicular, but inclining more to
ne ſide than the other. The fore-part of
is proceſs, where it joins the naſal plate of
e *os ethmoides*, is thin and ſtreight. Theſe
vo parts have been deſcribed as two diſtinct
roceſſes by ſome.

The depreſſions, ſinuoſities, and *foſſæ*, on
e external ſurface of this *ſphenoid* bone, may
reckoned up to a great number, *viz.* two
the temporal *apophyſes* where the *crotaphite*
uſcles lodge.—Two on the *orbitar* proceſſes,
make way for the globes of the eyes.——
wo between the *temporal* and *ſpinous* proceſſes,
r receiving the temporal bones.——Two be-
veen the plates of the *pterygoid* proceſſes, where
e *muſculi pterygoidei interni* and *ptery ſtaphy-*
i interni are placed.———Two between
e *pterygoid* and *orbitar* proceſſes, for forming
e holes common to this and to the *cheek* and
axillary bones. Two on the lower ends of
e *al'form* proceſſes, which the *palate* bones
ter into.——Two at the roots of the *tem-*
ral and *pterygoid* proceſſes, where the largeſt
are of the external *pterygoid* muſcles have
eir riſe. ——Two at the ſides of the *pro-*
ſſus azygos, for forming part of the noſe, &c.
What I deſcribed under the name of *tempo-*

(*b*) Albin. Tab. oſſ. 5. fig. 2. 6. A A.——Bertin. Mem. de
cad. des ſciences 1744.—Suc. planche viii. fig 2. 3. 4. 5. 6.

ral and *ſpinous proceſſes* on the out ſide of the ſcull, are likewiſe ſeen on its inſide, where they are concave, for receiving part of the brain; and commonly three *apophyſes* on the internal ſurface of the *ſphenoid* bone are only mentioned.——Two riſing broad from the fore-part of its body, become ſmaller as they are extended obliquely backwards.——The third ſtanding on a long tranſverſe baſe, near the back-part of the body of this bone, riſes nearly erect, and of an equal breadth, terminating often in a little knob on each ſide. The three are called *clinoid*, from ſome reſemblance which they were thought to have to the ſupporters of a bed. Sometimes one or both the anterior *clinoid* proceſſes are joined to the ſides of the poſterior one, or the body of the bone itſelf.—From the roots of the anterior *clinoid* proceſſes the bone is extended on each ſide outwards and forwards, till it ends in a ſharp point, which may have the name of the *tranſverſe ſpinous* proceſſes.——Between, but a little farther back than the two anterior *clinoid* proceſſes, we ſee a protuberance conſiderably ſmaller than the poſterior *clinoid* proceſs, but of its ſhape.—Another proceſs from between the tranſverſe proceſſes, often forces itſelf forwards into the *os ethmoides*.

Within the ſcull, there are two ſinuoſities in the internal part of each wing of the *ſphenoid* bone, for receiving the middle part of the brain.——One between the tranſverſe ſpinous proceſſes, for lodging the part of the brain where the *crura medullæ oblongatæ* are.—Immediately before the third or middle *clinoid*

proceſs,

roceſs, a ſingle pit generally may be remark-
d, from which a *foſſa* goes out on each ſide
the holes through which the optic nerves
aſs. The pit is formed by the conjoined op-
c nerves; and in the *foſſæ* theſe nerves are
dged, as they run divided within the ſcull.—
etween that third protuberance and the poſte-
or *clinoid* proceſs, the larger pit for the *glan-*
la pituitaria may be remarked. This cavity,
ecauſe of its reſemblance to a *Turkiſh* ſaddle,
always deſcribed under the name of *ſella*
urcica, or *ephippium*.——On the ſides of the
ſterior *clinoid* proceſs a *foſſa* may be remark-
, that ſtretches upwards, then is continued
rwards along the ſides of the *ſella Turcica*,
ar to the anterior *clinoid* proceſſes, where a
t on each ſide is made. Theſe *foſſæ* point
t the courſe of the two internal *carotid* ar-
ries, after they have entered the ſcull.—Be-
des all theſe, ſeveral other *foſſæ* may be ob-
ved, leading to the ſeveral holes, and im-
inted by the nerves and blood-veſſels.

The holes on each ſide of the *os ſphenoides*
e ſix proper, and three common.——The
ſt is the round one immediately below the an-
ior *clinoid* proceſſes, for the paſſage of the
tic nerve, and of the branch of the inter-
l *carotid* artery that is ſent to the eye.——
e *ſecond* is the *foramen lacerum*, or large
between the tranſverſe ſpinous and orbitar
oceſſes: The interior end of which ſlit is
ge; and, as it is extended outwards, it be-
mes narrower. The outer end of it is form-
in the *os frontis*; and therefore this might
reckoned among the common *foramina*.

Through it the third, fourth, the firſt branch of the fifth, and the greater ſhare of the ſixth pair of nerves, and an artery from the internal carotid, go into the orbit. Sometimes a ſmall branch of the external carotid enters near its end, to be diſtributed to the *dura mater* (a), and a vein, ſome call it the *venous duct*, or *Nuck's aquæduct*, returns through it to the cavernous *ſinus.*——The *third* hole, ſituated a little below the one juſt now deſcribed, is calle *rotundum*, from its ſhape. It allows paſſag to the ſecond branch of the fifth pair of nerves, or ſuperior maxillary nerve, into the bottom of the orbit.——The *fourth* is the *foramen o vale*, about half an inch behind the round hole. Through it the third branch of the fifth pair, o inferior *maxillary* nerve, goes out; and ſometimes a vein from the *dura mater* paſſes o here (b).—— Very near the point of the ſpinou proceſs is the *fifth* hole of this bone: It i ſmall and round, for a paſſage to the larg artery of the *dura mater*, which often is accompanied with a vein.——The *ſixth* prop hole (c) cannot be well ſeen, till the cuneifor bone is ſeparated from all the other bones o the *cranium*; for one end of it is hid by a ſma protuberance of the internal plate of the *pter goid* proceſs, and by the point of the *proceſſ*

petroſ

(a) Winſlow, Expoſition anatomique du corps humain, tr des arteries, § 60. et de la tête, § 26.

(b) Ingraſſ. Commentar. in Galen. de oſſib. lib. 1. cc ment. 8.

(c) Veſal. Anat: lib. 1. cap. 12.——Euſtach. tab. fig 13. & 16.—Vidus Vidius, Anat. lib. 2. cap. 2. expl tab. 5. & tab. 5 fig. 8. 9. 10. lit. O.

roſus of the *temporal* bone. Its canal is ex-
ded above the inner plate of the *pterygoid*
ceſs; and where it opens into the cavity of
noſe, it is concealed by the thin laminous
t of the *palate* bone. Through it a conſide-
le branch of the ſecond branch of the *fifth*
r of nerves is reflected.——Often in the
ddle of the *ſella Turcica* a ſmall hole or two
rce as far as the cellular ſubſtance of the
ne; and ſometimes at the ſides of this *ſella*,
or more ſmall holes penetrate into the
enoidal ſinuſes. Theſe obſervations afford
ſome anatomiſts (*a*) an argument of weight
heir days in defence of *Galen* (*b*), who aſ-
ed the deſcent of the *pituita* that way into
ſinuſes below.

he *firſt* of the common holes is that unequal
re at the ſide of the *ſella Turcica*, between
extreme point of the *os petroſum* and the
ous proceſs of the cuneiform bone. This
only appears after the bones are boiled;
in a recent ſubject its back-part is covered
a thin bony plate that lies over the internal
tid artery, and further forward it is filled
a cartilaginous ligament, under which the
ilaginous part of the *Euſtachian tube* is
ed: It was by this paſſage that the ancients
eved the *ſlimy matter* was conveyed from
eumunctory of the brain, the *glandula pi-
aria*, to the *fauces*.——The *ſecond* common
is the large diſcontinuation of the exter-
ſide of the orbit, left between the orbitar
proceſſes

) Jac. Sylv. Calumniæ ſecundæ amolitio.—Laurent. Hiſt.
lib. 2. quæſt. 11.

) Galen. De uſu part. lib. 9. cap 1.

proceſſes of the cuneiform bone, the *os max illare*, *malæ*, and *palati*. In this large hole th fat for lubricating the globe of the eye an temporal muſcle is lodged, and branches of th ſuperior maxillary nerve, with ſmall arteri from the carotid and veins paſs.——The *thir* hole is formed between the baſe of this bon and the root of the orbitar proceſs of the p late-bone of each ſide. Through this a branc of the external carotid artery, and of the ſe cond branch of the fifth pair of nerves, a allowed a paſſage to the noſtrils, and a retur ing vein accompanies them. Sometimes, ho ever, this hole is proper to the palate bone, b ing entirely formed out of its ſubſtance.

Under the *ſella Turcica*, and ſome way fa ther forward, but within the ſubſtance of th *ſphenoid* bone, are two *ſinuſes*, ſeparated by bony plate. Each of them is lined with membrane, and opens into the upper and bac part of each noſtril by a round hole, whi is at their upper fore part. This hole is n formed only by the *os ſphenoides*, which h an aperture near as large as any tranſve ſection of the *ſinus*, but alſo by the *pal* bones which are applied to the fore part theſe *ſinuſes*, and cloſe them up, that hole o ly excepted, which was already mentione Frequently the two *ſinuſes* are of unequal menſions, and ſometimes there is only o large cavity, with an opening into one n ſtril. Theſe cavities are likewiſe ſaid (*a*) be extended ſometimes as far back as the gre *foramen* of the occipital bone. In other ſ

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(*a*) Albin. de oſſib. § 39.

they are not to be found, when the bone
ompoſed of large cells (*a*). Some (*b*) men-
a cavity within the partition of the *ſinuſes* ;
t is ſmall.——The *ſphenoidal ſinuſes* ſerve the
uſes as the frontal do.

As this bone is extremely ragged and une-
, ſo its ſubſtance is of very different thick-
being in ſome places diaphanous ; in o-
it is of a middle thickneſs, and its mid-
ack part ſurpaſſes the greateſt ſhare of the
ium in thickneſs.

he *os ſphenoides* is joined, by its wings,
e *parietal* bones above, to the *os frontis*
ſſa malarum before, to the *temporal* bones
d ;—— By the fore part of its body and
us proceſſes, to the *frontal* and *ethmoid*
s ;—by its back part, behind the two *ſinu-*
to the *occipital*, where it looks like a bone
the *epiphyſes* taken off, and, as was for-
y obſerved in the deſcription of the occi-
bone, it cannot be ſeparated without vio-
in adults ;—— to the *palate* bones, by
nds of the *pterygoid* proceſſes, and ſtill
by the fore-part of the internal plates of
terygoid proceſſes, and of the *ſinuſes* ;—to
axillary bones, by the fore-part of the
nal *pterygoid* plates ;— to the *vomer* and
plate of the *os ethmoides*, by the *pro-*
azygos. All theſe conjunctions, except
aſt, which is a *ſchindyleſis*, are ſaid to be
e ſuture proper to this bone ; though it is
ſt ſight evident, that ſeveral other ſutures,
as

Veſal. lib. 1. cap. 6.

Id. ibid.

as the *tranſverſe*, *ethmoidal*, *&c.* are confound
with it.

We ſee now how this bone is joined to
the bones of the *cranium*, and to moſt of
upper jaw ; and therefore obtained the na
of the *wedge-like bone*.

The uſes are ſo blended with the deſcripti
as to leave nothing new to be added concerni
them.

The *ſphenoidal* bone is almoſt compleat i
fœtus of nine months ; only the great *al*
parate after maceration from the body of
bone.—The *proceſſus azygos* is very large
hollow ;——the thin triangular proceſſes are
oſſified —— the internal ſurface of the body
unequal and porous ; ——— the *ſinuſes* do
appear.

Whoever is acquainted with each bone of
cranium, can, without difficulty, examine t
as they ſtand united, ſo as to know the ſha
ſizes, diſtances, *&c.* of their ſeveral p
and the forms, capacities, *&c.* of the cav
formed by them, which is of great uſe tow
underſtanding the anatomy of the parts co
guous to, contained within, or connecte
them. Such a review is neceſſary, after
ſidering each claſs of bones. Thus the or
noſtrils, mouth, face, head, ſpine, *thorax* pe
trunk, extremities, and ſkeleton, ought likew
to be examined.

The *FACE* is the irregular pile of bo
compoſing the fore and under part of the h
which is divided, by authors, into the u
and lower *maxillæ* or jaws.

he *ſuperior maxilla* * is the common de- tion given to the upper immoveable ſhare he face; though, if we would follow *Cel- a)*, we ſhould apply the word *maxilla* to lower jaw only, and the name *mala* his upper jaw. In complaiſance to pre- g cuſtom, I ſhall, however, uſe the terms ow commonly employed. The ſhape e ſuperior jaw cannot eaſily be expreſſed; s it neceſſary, provided the ſhape and ſi- on of all the bones which compoſe it are ibed. It is bounded above by the tranſverſe e, behind by the fore-part of the *ſphenoid* , and below by the mouth.

e upper jaw conſiſts of ſix bones on each of a thirteenth bone which has no fel- placed in the middle, and of ſixteen The thirteen bones are, two *oſſa naſi*, *oſſa unguis*, two *oſſa malarum*, two *oſſa llaria*, two *oſſa palati*, two *oſſa ſpongioſa ora*, and the *vomer*.

e *oſſa naſi* are placed at the upper part e noſe;——the *oſſa unguis* are at the in- *canthi* of the orbits;——*oſſa malarum* the prominence of the cheeks;——*oſſa llaria* from the ſide of the noſe, with the lower and fore part of the upper jaw, he greateſt ſhare of the roof of the h;——*oſſa palati* are ſituated at the back- of the palate, noſtrils, and orbit;---*oſſa oſa* are ſeen in the lower part of the *na-* -and the *vomer* helps to ſeparate theſe two es.

The

αγων, γένος, mandibula.
Lib. 8. cap. 1.

The bones of the *upper jaw* are joined the bones of the ſcull by the *ſchindyleſis* ſutures already deſcribed as common to *cranium* and *face*, and they are connected each other by *gomphoſis* and fifteen ſutures.

The *gomphoſis* only is where the teeth fixed in their ſockets, and the *ſchindyleſ* only where the edges of the *vomer* are joined other bones.

The ſutures are generally diſtinguiſhed numbers, which have been differently appl and therefore I join thoſe (*a*) who prefer giving names to each, which may be e contrived from their ſituation, or from bones which they connect.

The firſt is the *anterior naſal* *, whic ſtreight, and placed longitudinally in the mi fore-part of the noſe.

The ſecond and third are the *lateral naſ* which are at each ſide of the noſe, and al parallel to the firſt ſuture.

Each of the two *lacrymal* is almoſt ſem cular, and is placed round the *lacrymal* gr

The ſixth and ſeventh are the *internal tar*: each of which is extended obliquely the middle of the lower ſide of an orbit to edge of its baſe.

The two *external orbitars* are continued, from the end of the internal orbitar, to under and fore-part of the cheek.

(*a*) Vander Linden. Medicin. phyſiolog. cap 13. art. —Rolfinc. Anat. lib. 2. cap. 25.—Schenk. Schol. part par 2. cap. 5.

* Naſalis recta.

† Naſalis obliqua.

The tenth is the *myſtachial,* which reaches
ly from the lower part of the *ſeptum narium*
between the two middle *dentes inciſores.*

The *longitudinal palate* * ſuture ſtretches
m the middle of the foremoſt teeth through
middle of all the palate.

The *tranſverſe palate* one † runs acroſs the
ate, nearer the back than the fore-part of

Each of the two *palato maxillary* is at the
k-part of the ſide of each noſtril.

The fifteenth is the *ſpinous,* which is in the
ddle of the lower part of the noſtrils. This
y perhaps be rather thought a double *ſchin-*
eſis.

The connection of the *oſſa ſpongioſa* to the
of each noſtril, is ſo much by a mem-
ne in young ſubjects, by a ſort of hook and
erwards by concretion or union of ſubſtance
adults, that I did not know well how to
k it: But if any chuſes to call it a ſuture,
addition of two *tranſverſe naſal* ſutures
y be made to thoſe above named.

Theſe ſutures of the face (formerly called
moniæ) have not ſuch conſpicuous indenta-
ns as thoſe of the ſcull have; the bones
e not having ſubſtance enough for forming
ge indentations, and there being leſs neceſ-
for ſecurity againſt external injuries, or
internal protruding force, than in the *cra-*
m. —— Theſe ſutures often diſappear in old
ple, by the bones running into each other;
ich can do little prejudice, becauſe the prin-

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* Laquearis, palataria recta.

† Arcuata, palatina poſtica.

cipal uſe of the bones being ſo numerous here, is to allow them to be extended into a prope form.

It is evident, from the manner of the con junction of theſe bones, that they can have n motion, except in common with the *cranium.*

The purpoſes which this pile of bones ſerves will be ſhewn in the deſcription which I am t give of each of them.

OSSA NASI, ſo named from their ſitu ation at the root of the noſe, are each of a irregular oblong ſquare figure, being broade at their lower end, narroweſt a little highe than their middle, and becoming ſomewha larger at the top, where they are ragged an thickeſt, and have a curvature forwards, th their connection with the *frontal* bone migh be ſtronger.——Theſe bones are convex exte nally, and thereby better reſiſt any violen from without; and they are concave internall for enlarging the cavity of the noſe.

The lower edge of theſe bones is unequa and is ſtretched outwards and backwards, t join the cartilages of the noſtrils.—Their ante rior ſide is thick, eſpecially above, and unequa that their conjunction to each other might b ſtronger; and a ſmall riſing may be remarke on their inner edge, where they are ſuſtaine by the *ſeptum narium.*——Their poſterior ſid at its upper half, has externally a depreſſio where it is overlopped ſome way by the *max lary* bones, while its lower half covers th bones: By which contrivance, they do n yield eaſily to preſſure applied to their fore-p or ſides.

A ſmall hole is frequently to be obſerved on eir external ſurface, into which two, three, r four holes, which appear internally, termi- te for the tranſmiſſion of ſmall veins ; ſome- mes the holes go no further than the *cancelli* the bones.

The *naſal bones* are firm and ſolid, with ry few *cells* or *cancelli* in them ; the thin bſtance of which they conſiſt not requiring uch marrow.

They are joined above to the *frontal* bone, the middle of the *tranſverſe* ſuture ;——be- nd, to the *maxillary* bones, by the *lateral na-* ſutures ;——Below, to the cartilages of the ſe ;——Before, to one another, by the *ante-* r *naſal* ſuture ;——internally, to the *ſeptum* *rium.*

Theſe bones ſerve to cover and defend the ot of the noſe.

In an infant the *naſal bones* are proportio- lly ſhorter, and leſs thick at their upper-part, an in an adult, but are otherwiſe compleat.

OSSA UNGUIS, or *LACRIMALIA*, ſo named, becauſe their figure and magni- de are ſomething near to thoſe of a nail of e's finger, and becauſe the tears paſs upon em into the noſe.

Their external ſurface is compoſed of two ooth concavities and a middle ridge.—— e depreſſion behind forms a ſmall ſhare of orbit for the eye-ball to move on, and the before is a deep perpendicular canal, or *ſa*, larger above than below, containing part the lacrymal *ſac* and *duct*. This is the part t ought to be pierced in the great operation for the *fiſtula lacrymalis.*——This *foſſa* o the bone is cribriform, or has a great numbe of ſmall holes through it, that the filament from the membrane which lines it, inſinuatin themſelves into theſe holes, might prevent ſeparation of the membrane, and ſecure th bone in its natural ſituation.——The ridg between theſe two cavities of the *os unguis*, i the proper boundary of the orbit at its inter nal *canthus;* and beyond which ſurgeons ſhou not proceed backwards in performing oper tions here.——The internal or poſterior ſurfac of this bone conſiſts of a furrow in the mi dle of two convexities.

The ſubſtance of the *os unguis* is as thin paper, and very brittle; which is the reaſo that thoſe bones are often wanting in ſkel tons, and need little force to pierce them in l ving ſubjects.

Each of theſe bones is joined, above, to th *frontal* bone, by part of the *tranſverſe* ſuture ——behind, to the *os planum* of the *ethmo* bone, by the ſame ſuture;—before, and belo to the *maxillary* bone, by the *lacrymal* ſutur —internally, the *oſſa unguis* cover ſome of th *ſinus ethmoidales;* nay, are really continuo with the bony *lamellæ* which make up th ſides of theſe cells; ſo that they are as muc part of the *ethmoid* bone as the *oſſa plana.*

Theſe unguiform bones compoſe the anteri internal parts of the orbits, lodge a ſhare o the lacrymal ſac and duct, and cover the *ethmoid* cells.——Their ſituation and tender ſubſtance make a raſh operator in danger of deſtroying a conſiderable ſhare of the organ o

ſmellin

elling, when he is performing the operation
the *fiſtula lacrymalis*; but when theſe
nes are hurt, they caſt off without much dif-
ulty, and conſequently the wound is ſoon
red, unleſs the patient labours under a gene-
cacoethes, or there is a prediſpoſition in the
nes to *caries*; in which caſe, a large train
bad ſymptoms follow, or, at beſt, the cure
oves tedious.

Theſe bones are fully formed in a new born
ild.

OSSA MALARUM * was the name given
Celſus, as was already remarked, to all the
per jaw; but is now appropriated to the pro-
inent ſquare bones which form the cheek
each ſide.—Before, their ſurface is con-
x and ſmooth; backward, it is unequal and
ncave, for lodging part of the *crotaphyte*
uſcles.

The four angles of each of theſe bones have
en reckoned proceſſes by ſome.——The one
the external *canthus* of the orbit, called the
perior orbitar proceſs, is the longeſt and thick-
.——The ſecond terminates near the middle
the lower edge of the orbit in a ſharp point,
d is named the *inferior orbitar* proceſs.——
he third, placed near the lower part of the
eek, and thence called *maxillary*, is the
orteſt, and neareſt to a right angle.——The
urth, which is called *zygomatic*, becauſe it is
tended backwards to the *zygoma* of the tem-
oral bone, ends in a point, and has one ſide
eight, and the other ſlopping.—Between the

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* Jugalia vel zygomatica, hypopia, ſubocularia.

two orbitar angles there is a concave arc which makes about a third of the external ci cumference of the orbit, from which a fifth pro cefs is extended backwards within the orbit, t form near one third of that cavity; and hen it may be called the *internal orbitar* procefs.— From the lower edge of each of the *offa mal rum*, which is between the maxillary and zyg matic proceffes, the *maffeter* mufcle takes its rigin; and from the exterior part of the *zygomat* procefs, the *mufculus diftortor oris* rifes; in bo which places the furface of the bone is roug

On the external furface of each cheek-bo one or more fmall holes are commonly foun for the tranfmiffion of fmall nerves or bloo veffels from, and fometimes into the orbit.— On the internal furface are the holes for t paffage of the nutritious veffels of thefe bon ——— A notch on the outfide of the *internal* *bitar* procefs of each of thefe bones affifts form the great flit common to this bone a to the fphenoid, maxillary, and palate bones.

The fubftance of thefe bones is, in prop tion to their bulk, thick, hard, and folid, wi fome *cancelli*.

Each of the *offa malarum* is joined, by fuperior and internal orbitar proceffes, to t *os frontis*, and to the orbitar procefs of t *fphenoid* bone, by the *tranfverfe* future.— the edge between the internal and inferior bitar proceffes, to the *maxillary* bone, by the *ternal orbitar* future.—By the fide between maxillary and inferior orbitar procefs, ag to the maxillary bone, by the *external orbi*

futu

re.——By the zygomatic proceſs, to the *os*
porum, by the *zygomatic* ſuture.
The cheek-bones are entire, and fully oſſi-
in all their parts in infants.
OSSA MAXILLARIA SUPERIORA,
the largeſt bones, and conſtitute the far
ater part of the upper jaw, which has ap-
priated the name of *maxillaria* to them.
e figure of one of them, or of the two
en joined, is ſo irregular, that words can
rce give an idea of it.
The proceſſes of each *os maxillare* may be
koned ſeven.——The *firſt* is the long naſal
at its upper and fore-part, which is broad
ow, and turns ſmaller, as it riſes upwards, to
ke the ſide of the noſe.——At the root of
, a tranſverſe ridge may be obſerved with-
he noſtrils, which ſupports the fore-part of
upper edge of the *os ſpongioſum inferius*.—
e *ſecond* is produced backwards and outwards,
n the root of the naſal proceſs, to form the
er ſide of the orbit ; and therefore may be
ed *orbitar*.—The edge of this orbitar pro-
, and the ridge of the naſal one, which is
inued from it, make a conſiderable portion
he external circumference of the orbit.—
m the proper orbitar proceſs, a very rough
ngular ſurface is extended downwards and
wards, to be connected to the cheek-bone ;
therefore may be called the *malar* proceſs,
n the loweſt protuberant part of which
e ſhare of the maſſeter muſcle takes its riſe.
-Behind the orbitar proceſs, a large tubero-
or bulge of the bone appears, which is e-
med the *fourth* proceſs.——On the internal
part

part of this we often meet with a ridge, almo of the ſame height with that in the naſal pr ceſs, which runs tranſverſely, and is covered a ſimilar ridge of the *palate* bone, on which back part of the upper edge of the *os ſpong ſum inferius* reſts.——The convex back-part this tuberoſity is rough for the origin of p of the external *pterygoid* muſcle (*a*), and mo internally is ſcabrous, where the palate ſphenoid bones are joined to it.——That ſp gy protuberance * at the lower circumfere of this bone, where the ſockets for the te are formed, is reckoned the *fifth*.—The ſi is the horizontal plate, which forms the gre er part of the baſe of the noſtrils, and of the mouth; its upper ſurface, which longs to the noſtrils, is very ſmooth, but other below is arched and rough, for the ſtro er adheſion of the membrane of the mo which is ſtretched upon it, and in chewi ſpeaking, *&c.* might otherwiſe be liable to ſeparated.—The *ſeventh* riſes like a ſpine fr the inner edge of the laſt, and forms a ſ part of the partition of the noſtrils.

The depreſſions in each *maxillary* bone 1. A ſinuoſity behind the orbitar proceſs, m by the *temporal* muſcle. 2. A pit immedia before the ſame proceſs, where the origin of *muſculus elevator labiorum communis*, and *el tor labii ſuperioris*, with a branch of the pair of nerves, are lodged ſecurely. 3. hollow arch of the palate. 4. The ſemici lar great notch, or entry to the lower par

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(*a*) Albin. de oſſib. § 79.

* φατνια.

noſtrils, betwixt the root of the naſal ceſs and ſpine of the palate-plate.—Be- this, the fore-part of the bone is flatted, ometimes hollowed by the *muſculus depreſ- abii ſuperioris.* 5. Sockets for the teeth †: number of theſe ſockets is uncertain; for ſame number of teeth is not in all peo- and the four backmoſt teeth of each ſide ach jaw vary greatly in their number of s; and when the teeth of a living perſon out, or are taken away, the ſockets fill up an oſſeous net-work, which becomes ſolid wards. 6. The *lacrymal foſſa* in the *naſal pro-* which aſſiſts the *os unguis* to form a paſſage he *lacrymal duct.* This part of the bone ing this *foſſa* is ſo firm and ſtrong that a ſur- ſcarce can perforate it with the ordinary in- ents for the *fiſtula lacrymalis*, and therefore t to avoid it in doing this operation.—— ediately on the outſide of this, there is a depreſſion, from which the inferior or oblique muſcle of the eye has its origin (*a*). e canal on the upper part of the great tu- ity within the orbit, which is almoſt a com- hole; in this a branch of the ſuperior ma- y nerve paſſes.—Beſides theſe, the ſupe- urface of the great bulge is concave, to re- the under part of the eye.—Immediate- ove the tranſverſe ridge in the naſal pro- a ſmall hollow is formed by the *os ſpongio-* —In ſome ſubjects, the naſal proceſs ſmall round pit above the lacrymal duct, where

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όθρια, ὀλμίσκοι, alveoli, foſſulæ, mortariola, fræna, cavæ, pralſepiola, loculamenta.

Winſlow, Expoſition anatomique des os ſecs, § 276.

where the little tendon or ligament of th
orbicular muſcle of the eye-lids is inſerted.
is this tendon, and not the tendon of th
larger oblique muſcle of the eye, which the
is ſome hazard of cutting in the operation
the *fiſtula lacrymalis*.

The holes of this bone are two proper a
two common, which are always to be foun
beſides ſeveral others, whoſe magnitude, nu
ber, &c. are uncertain.——The firſt of
proper is the *external orbitar*, immediately
low the orbit, by which the infra-orbi
branch of the ſecond branch of the fifth pair
nerves, and a ſmall artery, come out, a
having paſſed in the canal, at the bottom
the orbit, deſcribed *numb.* 7. of the dep
ſions.—This hole is often double, and
when the nerve has happened to ſplit before
has eſcaped from the bone.—The ſecond is
foramen inciſivum, juſt behind the fore-te
which, at its under part, is one irregular h
common to both the *maxillary* bones when
are joined; but, as it aſcends, ſoon divi
into two, three, or ſometimes more hol
ſome of which open into each noſtril. Th
them ſmall arteries and veins, and a twig
the ſecond branch of the fifth pair of ner
paſs, and make a communication between,
join the lining coats of the noſe and mouth.
In ſome ſubjects, *Steno's* duct may be trac
ſome way on the ſide of theſe paſſages next
the noſe, and ſmall orifices may be obſerv
opening into the mouth.

The firſt common hole is that which appe
at the inner ſide of the back-part of the *tu*

ro

ity and of the ſockets of the teeth, and is med by a *foſſa* in this bone, and a corre- nding one in the *os palati*: through it a ve, which is a branch of the ſecond branch the fifth pair, runs to the palate.——The er common hole is the great ſlit in the out- of the orbit deſcribed already, as the ſe- d common hole of the ſphenoid bone.

On the naſal proceſs often holes may be ob- ed for the paſſage of veſſels to the ſub- ce of the bones; and, at the back-part of tuberoſity, ſeveral *foramina* are placed, the tranſmiſſion of nerves to the cavity in: but theſe are uncertain.

ll the body of the *maxillary* bone is hollow leaves a large *ſinus* a-kin to the *frontal* and *noid*, which is commonly, but unjuſtly, d *antrum Highmorianum* *. When the *os illare* is ſingle or ſeparated from all the o- bones of a ſkeleton, its *antrum* appears to a large aperture into the noſtrils; but, recent ſubject, it is ſo covered at its back- by the *palate* bone; in the middle, by the *ſpongioſum inferius*; before, by a ſtrong nbrane, that one or ſometimes two holes, e larger than a crow-quill, are only left at upper part; which, after a ſhort winding reſs, open into the noſtrils between the *oſſa ſpongioſa*.—At the bottom of this ca- we may often obſerve ſome protuberances, hich the ſmall points of the roots of the are contained (*a*).—This cavern and ſockets of the teeth are often divided by the

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Genæ.

) Highmore, Diſquiſ. anat. lib. 3. part. 2. cap. 1.

the interpoſition only of a very thin bony plat which is liable to be eroded by acrid matt collected in the *antrum*, or to be broke in drawing a tooth (*a*). The ſymptoms of a co lection of a matter here naturally lead us to th practice of pulling out the teeth, and piercin through this plate into the *antrum*, to procu an evacuation of the collected matter; b which conſiderable ſervice is frequently done (

The *maxillary ſinuſes* have the ſame uſes the *frontal* and *ſphenoidal*; and the ſituati of the *ſinuſes* is ſuch, that the liquor drill from them, from the cells of the ethmoid a palate bones, and from the lacrymal du may always moiſten all the parts of the me brane of the *nares* in the different ſituatio which the head is in.

Though the membranes which line t *frontal*, *ſphenoidal*, and *maxillary ſinuſes*, continuations of the one which covers t bones within the noſe; yet they are mu thinner than it is, and have ſo much ſmal veſſels, that the injection which makes t membrane of the noſe red all over, fills o ſome few veſſels of the *maxillary ſinuſes*, a ſcarce is obſerved in the *frontal* and *ſpheno* Are not the larger veſſels intended for a mo plentiful ſecretion of a viſcid liquor to defe the membrane from the effects of the *perſ tus*, which is conſtantly through the noſe? A not the membranes which have the ſmal veſſels, *cæteris paribus*, the moſt ſenſible? A

(*a*) Highmore, ibid.

(*b*) Cowper in Drake's anthropol. book 3. chap. 10. Medical Eſſays and obſerv. vol. 5. art. 30.

ot many phænomena of ſmelling, inflammaions of theſe parts, *megrim*, *polypi*, *&c.* deending on this ſtructure of theſe membranes?

The ſubſtance of the *oſſa maxillaria* is comact and firm, except at the inferior proceſſes, which the teeth are lodged, where it is very ongy.

The *maxillary* bones are joined above by the pper ends of their naſal proceſſes to the *os ontis*, by the *tranſverſe* ſuture;——at the ſides f theſe proceſſes, to the *oſſa unguis*, by the *crymal* ſutures;——to the *naſal* bones, by the *teral naſal* ſutures;——by their orbitar proceſs, to the *cheek* bones, by the *external orbitar* tures;—by the internal ſides of the internal bitar proceſſes, to the *oſſa plana*, by part of e *ethmoidal* ſuture;———by the back part of e tuberoſities, to the *palate* bones, by the *turæ palato-maxillares*;———by the poſterior ges of their palatine *lamellæ*, to the *oſſa lati*, by the *tranſverſe* palate ſuture;———by eir naſal *ſpines*, to the *vomer*, by the *ſpiur* ſuture;——by their ſockets, to the teeth *gomphoſis*;——by the internal edge of the late-plate, to one another, by the *longitudi-l* palate-ſuture; on the upper and fore-part which a furrow is left for receiving the rtilage which forms the partition of the noils;——between the fore-part of the noſtrils d mouth, to each other, by the *myſtachial* ſure;——ſometimes they are connected to the *a ſpongioſa inferiora*, by a plain concretion or ion of ſubſtance.

Theſe bones form the greater part of the ſe and of the roof of the mouth, and a

conſiderable

conſiderable ſhare of the orbit. They contai ſixteen teeth, give riſe to muſcles, tranſmiſſion to nerves, *&c.* as mentioned in the deſcription of their ſeveral parts.

In each of the *maxillary* bones of a new-born child, the external orbitar proceſs is hollow with remarkable holes in it;——there ar five ſockets for the teeth, of which the tw poſterior are very large, and, when divided b a ſecond croſs partition, make the number o ſockets ſix (*a*).———The palate-plate is cribri form about the middle.——The great tuberoſity is not formed;——inſtead of the *antru* there is only an oblong depreſſion at the ſide o the noſtrils.

OSSA PALATI are commonly deſcribed a two ſmall ſquare bones, at the back-part of th palate or roof of the mouth, though they ar of much greater extent, being continued u the back-part of the noſtrils to the orbit (b Each palate-bone may therefore be divided i to four parts, the palate ſquare bone, the pt rygoid proceſs, naſal *lamella*, and orbitar pr ceſs.

The ſquare bone is unequally concave, f enlarging both the mouth and cavity of th noſe. The upper part of its internal ed riſes in a ſpine, after the ſame manner as th palate-plate of the *maxillary* bone does, to joined with the *vomer.*———Its anterior ed is unequally ragged, for its firmer connecti

wi

(*a*) Albin. Oſteogen. tab. 5. fig. 45——Ungebav. dentit. ſecund. jun. § 1.

(*b*) Euſtach. tab. 47. fig. 1. 3. 6. 7. 8.——Vidus dius, de Anat. lib. 2. cap. 2. explicat. tab. 6. fig. 19.—W iſlow Memoires de l'acad des ſciences, 1720.

ith the palate-proceſs of the *os maxillare.*—
he internal edge is thicker than the reſt, and
f an equal ſurface, for its conjunction with
s fellow of the other ſide.———Behind, this
one is ſomewhat in form of a creſcent, and
ick, for the firm connection of the *velum pen-*
ulum palati; the internal point being produced
ckwards, to afford origin to the *palato-ſtaphy-*
nus or *azygos* muſcle.———This ſquare bone is
ell diſtinguiſhed from the *pterygoid* proceſs by
perpendicular *foſſa*, which, applied to ſuch
other in the *maxillary* bone, forms a paſſage
r the palatine branch of the fifth pair of
rves; and by another ſmall hole behind this,
rough which a twig of the ſame nerve paſſes.
The *pterygoid* proceſs is ſomewhat triangular,
ving a broad baſe, and ending ſmaller above.
he back-part of this proceſs has three *foſſæ*
rmed in it; the two lateral receive the ends
the two plates of the ſphenoid bone, that are
mmonly compared to a bat's wing; the mid-
foſſa makes up a part of what it commonly
lled the *foſſa pterygoidea*; the fore-ſide of
s palatine pterygoid proceſs is an irregular
ncave, where it receives the back part of the
eat *tuberoſity* of the *maxillary* bone.———Fre-
ently ſeveral ſmall holes may be obſerved in
s triangular proceſs, particularly one near
middle of its baſe, which a little above
mmunicates with the common and proper
les of this bone already taken notice of.
The *naſal lamella* of this bone is extremely
n and brittle, and riſes upwards from the up-
ſide of the external edge of the ſquare
ne, and from the narrow extremity of the

pterygoid

pterygoid proceſs; where it is ſo weak, and, at the ſame time, ſo firmly fixed to the *maxillary* bone, as to be very liable to be broken in ſeparating the bones ——From the part where the plate riſes, it runs up broad on the inſide of the *tuberoſity* of the *maxillary* bone, to form a conſiderable ſhare of the ſides of the *maxillary ſinus*, and to cloſe up the ſpace between the *ſphenoid* and the great bulge of the maxillary bone, where there would otherwiſe be a large ſlit opening into the noſtrils (a). From the middle internal ſide of this thin plate, a croſs ridge placed on ſuch another of the maxillary bone is extended; on it, the back part of the *os ſpongioſum inferius* reſts.—Along the outſide of this plate, the perpendicular *foſſa* made by the palate nerve is obſerveable.

At the upper part of this naſal plate, the palate bone divides into two proceſſes, which I already named *orbitar*;—between which and the body of the *ſphenoid* bone, that hole is formed, which I mentioned as the laſt of the holes common to the *ſphenoid* bone.——Sometimes this hole is wholely formed in the *os palati*, by a croſs plate going from the one orbitar proceſs to the other. A nerve, artery, and vein belonging to the noſtrils paſs here.—The anterior of the two orbitar proceſſes is the largeſt, and has its fore-part contiguous to the back-part of the *maxillary ſinus*, and its upper ſurface appears in the bottom of the orbit, behind the back-part of the *os maxillare* and *pla-*

num

(a) Albin. de oſſib. § 88.

m.—It has cells behind reſembling thoſe of *e ethmoid* bone, to which it is contiguous; it placed on the aperture of the *ſinus ſphenoi-lis*, ſo as to leave only a round hole at its up-r fore part.—The other part of the orbitar ocefs is extended along the internal ſide of e upper back part of the maxillary *tuberoſity*, the baſe of the *ſphenoid* bone, between the ot of the *proceſſus azygos* and the pterygoid ocefs.

The palate ſquare part of this palate-bone, d its pterygoid proceſs, are firm and ſtrong, th ſome *cancelli*; but the naſal plate and or-ar proceſſes are very thin and brittle.

The palate-bones are joined to the *maxilla-* by the fore-edge of the palate ſquare bone, the *tranſverſe palate* ſuture:—By their thin al plates, and part of their orbitar proceſſes, the ſame bones, by the *palato-maxillares* ſu-es:—By their *pterygoid* proceſſes, and back-t of the *naſal plates*, to the *alæ veſpertilio-n*, by the *ſphenoid* ſuture:——By the tranſ-ſe ridges of the naſal plates, to the *oſſa gioſa inferiora*, by contact; hence frequent-there is an intimate union of the ſubſtance theſe bones in old ſculls:——By the orbitar ceſſes, to the *oſſa plana* and *cellulæ ethmoi-*, by the *ethmoid* ſuture:——To the body the *ſphenoid* bone, by the *ſphenoid* ſuture:— the internal edge of the ſquare bones, to h other, by the *longitudinal* palate ſuture; by their naſal ſpines, to the *vomer*, by the *ous* ſuture.

The palate-bones form part of the palate, trils, orbits, and *foſſæ pterygoideæ*, and they cover part of the *ſinus maxillares*, *ſphenoidales*, and *ethmoidei*.

Theſe bones are very complete in a new-born infant, the naſal plates being then thicker and ſtronger than in adults; but the orbita proceſſes have not the cells which appear i the bones of adults.

When we are acquainted with the hiſtory o theſe bones, the reaſon is evident, why th eyes are ſo much affected in ulcers of the pa late, as to be often attended with blindneſs which frequently happens in an ill-manage *lues venerea*; or why, on the other hand, th palate ſuffers from an *ægylops* (*a*).

OSSA TURBINATA, or *ſpongioſa inferiora*, reſemble the ſuperior *oſſa ſpongioſa* in ſhap and ſubſtance, but have their anterior and upper edges contiguous to the tranſverſe ridge of the naſal-proceſſes of the *maxillary* and *palate bones*.——From their upper ſtreight edg two ſmall proceſſes ſtand out: the poſterio which is the broadeſt, deſcends to cover ſome o the *antrum Highmorianum*; the anterior riſe up to join the *os unguis*, and to make part o the *lacrymal duct*.

Below the ſpongy bones already mentione there are ſometimes two others, one in eac noſtril, which ſeem to be a production of th ſides of the maxillary *ſinus* turned downwar (*b*). When this third ſort of ſpongy bones found, the middle one of the three in each noſtril is the largeſt, and the loweſt is the ſmal

c

(*a*) Hoffman. in Ephemerid. German. cent. 1. and 2. o ſerv. 135.

(*b*) Cowper in Drake's Anthropolog. book 3. chap. 10.

.——Beſides all theſe, there are often ſeveral her ſmall bones ſtanding out into the noſtrils, t, from their ſhape, might alſo deſerve the me of *turbinata*, but are uncertain in their lk, ſituation, and number (*a*).

The names of theſe bones ſufficiently declare ir ſpongy ſubſtance, which has no firm exnal plate covering it.

They are joined to the *oſſa maxillaria*, *pai*, and *unguis* in old ſubjects, by a firm union ſubſtance; and as this happens alſo frequent in people of no great age, ſome (*b*) are of inion, that they ſhould be eſteemed part of palate-bones; others (*c*) think, that ſince ir upper edge is continued by a plate to a t of the *os ethmoides*, they ought to be emed to be a part of this bone.

Their uſe is, to ſtraiten the noſtrils, to afd a large ſurface for extending the organ ſmelling, to cover part of the *antra maxilia*, and to aſſiſt in forming the under part of lacrymal ducts, the orifices of which into noſe are concealed by theſe bones.

The *oſſa turbinata* are nearly complete in a v born infant.

VOMER, or bone reſembling a ploughre, is the thirteenth of the upper jaw, with a fellow, forming the lower and backts of the partition of the noſe (*d*).

The

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a) Santorin. Obſervat. anatomic cap. 5. § 9.

b) Id. ibid. cap. 5. § 7.

c) Hunauld. in Memoires de l'acad. des ſciences, 1730.

d) Columb. de re anat. lib. 1. cap. 8.—Fallop. Obſervat. om.

The figure of this bone is an irregula rhomboid.—Its ſides are flat and ſmooth.— Its poſterior edge appears in an oblique direc tion at the back part of the noſtrils.——Th upper one is firmly united to the baſe of th *ſphenoid* bone, and to the naſal plate of th *ethmoid*; and, when it can be got ſeparated, i hollow, for receiving the *proceſſus azygos* o the *ſphenoid*.——The anterior edge has a lon furrow in it, where the middle cartilage o the noſe enters.——The lower edge is firml united to the naſal ſpines of the maxillary an palate bones.———Theſe edges of this bon are much thicker than its middle, which is a thin as the fineſt paper; by which, and the fir union or connection this bone has above an below, it can very ſeldom be ſeparated enti in adults: But, in a child, it is much mor eaſily ſeparated entire, and its ſtructure is mor diſtinctly ſeen; wherefore I ſhall examine a its parts of ſuch a ſubject.

Its ſituation is not always perpendicular, b often inclined and bended to one ſide, as we as the naſal plate of the *ethmoid* bone.

The *vomer* is convex at its upper part, an then is ſtreight, as it is extended downwar and forwards where it is compoſed of two plate the edges of which have a great number o ſmall proceſſes, diſpoſed ſomewhat like th teeth of a ſaw, but more irregularly, and ſe veral of them are reflected back. Betwee theſe plates a deep *foſſa* is left, which, ſo fa as the top of the curvature, is wide, and ha ſtrong ſides, for receiving the *proceſſus azyg* of the *ſphenoid* bone. Beyond the arch for

rds, the *foſſa* is narrower and ſhallower gra-
lly to the point of the bone, receiving for
e way the naſal *lamella ethmoidea*; which,
r the oſſification is complete, is ſo cloſely
ed to the *vomer* by the little proceſſes pier-
g into its ſubſtance, as to prevent any ſepa-
on; on which account it has been eſteemed
ſome (*a*) a part of the ethmoid bone. The
dle cartilage of the noſe fills up what re-
ns of the *foſſa* at its fore-part.———The
erior edge of the *vomer*, which appears
ve the back-part of the palate-bones, is
der above; but as it deſcends forwards, be-
es thinner, though it is ſtill ſolid and firm.
he lower edge of this bone, which reſts on
naſal ſpine of the *palate* and *maxillary*
es, has a little furrow on each ſide of a
l middle ridge, anſwering to the ſpines of
bones of different ſides, and the interſtice
een them. This edge, and the upper one
t in the pointed-fore-end of this bone.

he body of the *vomer* has a ſmooth ſur-
, and ſolid, but thin ſubſtance; and towards
des, where it is thickeſt, ſome *cancelli* may
bſerved, when the bone is broken.

is joined above to the *ſphenoid* and *ethmoid*
s, and to the middle cartilage of the noſe,
ſchindyleſis;—below, to the maxillary and
e bones, by the *ſpinous* ſuture.

he *vomer* divides the noſtrils, enlarges the
n of ſmelling, by allowing place for ex-
ding the membrane of the noſe on its
, and ſuſtains the palate-plates of the *ma-*

xillary

) Lieutaud. Eſſais anatomiques 1. ſect. l'os ethmoide.

xillary and *palate* bones, which otherwiſe mig be in hazard of being preſſed into the noſtrils while the *vomer* is ſecured from ſhuffling to o ſide or other by the double *ſchindyleſis*, b which it is joined to the bones above and b low.

Theſe then are all the bones which compo the upper jaw, except the teeth, which a ſo much a-kin to thoſe of the lower jaw, th I chuſe to make one deſcription ſerve for bot in which the differences obſervable in the ſhall be remarked, after the ſecond part of t face, the lower jaw, is examined; becau the ſtructure of the teeth cannot be well u derſtood, until the caſe in which they are is explained.

MAXILLA INFERIOR *, the low jaw conſiſts only of one moveable bone, a ſixteen teeth incaſed into it.

This bone, which is ſomewhat of the figu of the *Greek* letter υ, is ſituated at the low part of the face, ſo as its convex middle p is forwards, and its legs are ſtretched bac It is commonly divided into the chin, ſid and proceſſes.—The *chin* is the middle fo part, the extent of which to each ſide is mar ed on the external ſurface by the holes obſ vable there, and internally by the beginning an oblique ridge.—Beyond theſe the *ſides* a pear, and are continued till the bone, by ben ing upwards, begins to form the proceſſes.

On the fore-part of the *chin*, a tranſve ridge appears in the middle, on each ſide

whi

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* Γένυς, σιαγων, mandibula, facies.

ich the *muſculi quadrati*, or *depreſſores labii* *rioris*, and the *levatores labii inferioris*, de- ſs the bone: And below theſe prints, a ſmall ng may be obſerved, where the *depreſſores* nmence.——On the back-part of the chin, etimes three, always two, ſmall protube- ces appear in the middle. To the upper- ſt, when it is ſeen, the *frænum* of the gue is connected. From the middle one, *muſculi genioglоſſi* riſe; and from the low- the *geniohyoidei* have their origin. Below laſt, we ſee two rough ſinuoſities formed he *digaſtric* muſcles.

t the lower and fore-part of the external ace of each ſide of the lower jaw, a ſmall nence may be obſerved, where the *depreſ-* *labiorum communis* riſes. Near the upper of the ſide a ridge runs length-ways, hich the under part of the *muſculus bucci-* *r* is connected.——Internally, towards the er edge of each ſide, another ridge appears, which the *mylohyoidei* have their origin, to which the internal membrane of the s adheres.

the upper edge of both chin and ſides great many deep pits or ſockets, for re- ing the roots of the teeth. The number magnitude of theſe ſockets are various, be- of the different number, as well of the themſelves, as of their roots, in differ- people. Theſe ſockets in this lower jaw, ell as in the upper one, are leſs deep as old comes on; when freed from the teeth by means, they are ſome time after filled up an oſſeous net-work, which at laſt becomes entirely ſolid, and as ſmooth as any other p of the bone ; ſo that in a great many old j one cannot obſerve a veſtige of the ſock But then the jaw becomes leſs, and much n rower (*a*).—Hence we may know why the c and noſe of edentulous people are much ne er than before the teeth were loſt ; while th lips either fall in towards the mouth, or ſt prominent forwards.——When new teeth protruded, new ſockets are formed (*b*)—T lower edge of the chin and ſides is ſmooth equal, and is commonly called the *baſe* of lower jaw.—The ends of the baſe, where jaw turns upwards, are called its *angles* ; external ſurface of each of which has ſev inequalities upon it, where the *maſſeter* m is inſerted ; as the internal ſurface alſo where the *pterygoideus internus* is inſerted, a ligament extended from the *ſtyloid* proceſ the temporal bone is fixed.

The proceſſes are two on each ſide.— anterior ſharp thin *coronoid* ones have the *taphite* muſcles inſerted into them.— poſterior proceſſes or *condyles* * terminat an oblong ſmooth head, ſupported by a ce The heads whoſe greateſt length is tranſv and whoſe convexity is turned forwards, tipped with a cartilage, as the articulated p of all other moved bones are.—The fore of the root and neck of theſe *condyloid* p ceſſes are a little hollow and rough, where external *pterygoid* muſcles are inſerted.

(*a*) Veſal. Anat. lib 1. cap 10.

(*b*) Fallop. Obſerv. anat.

* Articulatorii.

The holes of the lower jaw are two on
ch ſide ; one at the root of the proceſ-
s internally, where a large branch of the
ird branch of the fifth pair of nerves en-
s with an artery, and a vein returns. A
all ſharp proceſs frequently jutts out back-
rds from the edge at the fore-part of this
le, to which a ligament extended from the
mporal bone is fixed (*a*), which ſaves the
rve and veſſels from being too much preſſed
the *pterygoid* muſcles.———From the lower
e of this hole, either a ſmall ſuperficial
nal or a furrow deſcends, where a branch
the nerve is lodged, in its way to the *my-*
hyoideus muſcle and ſublingual gland (*b*).———
e other hole is external, at the confines
the chin, where branches of the nerve and
ſels come out.——The canal betwixt theſe
o holes is formed in the middle of the ſub-
nce of the bone, and is pierced by a great
mber of ſmall holes by which the nerves
d blood-veſſels of the *cancelli* and teeth paſs.
is canal is continued a little further than the
ternal hole at the chin.——On account of the
ſels and nerves in the lower jaw, frac-
es of it may be attended with dangerous
mptoms.

The ſurface of the lower jaw is hard and
n, except at the ſpongy ſockets, where
wever it is ſtronger than the upper jaw.——
internal ſubſtance is cellular, without any
id partition between the *cancelli* in its mid-
e.———At the baſe, eſpecially of the chin,
where

(*a*) Weitbrecht. Syndeſmolog. fig. 32. 1.
(*b*) Palfyn. Anat. chirur, traite 5. chap. 6.

where this bone is moſt expoſed to injuries, th ſolid ſides of it are thick, compact, and hard.

The lower jaw generally receives the root of ſixteen teeth into its ſockets, by *gomphoſi* and its *condyloid* proceſſes, covered with cartilage, are articulated with the *temporal* bone in a manner that is not commonly deſcribe right: For, as was already mentioned in th deſcription of the temporal bones, not only th fore part of the cavity between the *zygomati* *auditory*, and *vaginal* proceſſes, but alſo the adjoining tubercle at the root of the *zygomati* proceſs of each *os temporum* is covered with ſmooth cartilage, for this articulation.— Here alſo an intermediate moveable cartilag is placed, which being thin in the middl and thick at the edges, is concave on bot ſides; and is connected ſo firmly by ligament to each *condyle*, as to follow the motions o the *condyle*; and ſo looſely to the *tempor* bone, as readily to change its ſituation fro the cavity to the tubercle, and to return agai while the common ligament of the articulation affords ſpace enough for ſuch a change o place backwards and forewards; but, like other ligaments of the joints by *ginglimus*, i ſtrong and ſhort at the ſides, to confine the lateral motions.

When therefore the teeth of both jaw coincide, the *condyles* are lodged ſecurely i the temporal cavities, but their motions t either ſide muſt be confined both by the firmneſs of the ligaments, and the riſing brim which are on each ſide of the cavities.—

hen the jaw is brought directly forwards,
e condyle and intermediate cartilages de-
end and advance forewards upon the tuber-
es.——In this ſituation the lateral motions
e a little more free than in the former one,
m the want of riſing brims to ſtop the con-
les.——When the fore-teeth of the lower
v are moved forewards, and to a ſide, the
ndyle of the oppoſite ſide is either advanced
m the cavity to the tubercle, while the
ndyle of the ſame ſide remains in the cavity;
if both condyles are on the tubercles, when
e jaw is moved obliquely to a ſide, the con-
le of the ſide to which the motion is made
les back from the tubercle to the cavity.——
hen the mouth is opened by the deſcent of
e lower jaw, the fore part of it, where the
reſſing muſcles are fixed, is drawn backwards,
well as downwards, while reſiſtance is made
the angles moving backwards by the *maſ-*
er and *internal pterygoid* muſcles, and, at the
ne time, the *external pterygoid* draw the
ndyles and their moveable cartilages fore-
rds; and therefore, when the mouth is open-
the condyles are carried forewards upon
e tubercles, and the axis of motion of the
ne is a little above its angles. But in this ſi-
ation there is leſs reſiſtance, than in any o-
r, to the condyles luxating forewards; a diſ-
e which ſeldom happens, except when people
e gaping too wide; and therefore the com-
n practice of nurſes, who ſupport the jaw of
ants when they are yawning, is reaſonable.—
In

In chewing there is a ſucceſſion of the motion
above deſcribed (*a*).

Here a general remark may be made, Th
where-ever moveable cartilages are found i
joints, either the articulated bones are of ſuc
a figure, or ſo joined and fixed by their liga
ments, that little motion would be allowe
without ſuch cartilages; or elſe ſome motion
are neceſſary to the right uſe of the member
which the form of the articulation would no
otherwiſe admit of. This will more fully ap
pear after the other joints with ſuch cartilage
are deſcribed.

In a child born to the full time, the lowe
jaw is compoſed of two bones, connected by
thin cartilage in the middle of the chin, whic
gradually oſſifies, and the two bones intima
ly unite.——In each of theſe bones there ar
five or ſix ſockets for teeth as in the upp
jaw.

After I have thus deſcribed the incaſeme
of the teeth, the inſertion of ſo many muſcle
of the tongue, and of the *os hyoides*, the con
nection of the membrane of the tongue to th
maxillary bone, and the motions of this bone
it is eaſy to ſee, that the lower jaw muſt be
principal inſtrument in manducation, deglut
tion, and ſpeech.

The *TEETH* are the hard white bodie
placed in the ſockets of both jaws. The
number is generally ſixteen above, and as ma

n

(*a*) For a more full account of this articulation, vid. E
dinburgh Medical eſſays and obſerv. vol. 1. art. 11. a
vol. 3. art 13.——Memoires de l'acad. des ſciences, 1744.

y below ; though ſome people have more, o-hers have fewer.

The broad thick part of each tooth which ppears without the ſocket, is the *baſe* or body *. —The ſmaller proceſſes ſunk into the *maxil-*, are the *roots* or *fangs*, which become gra-ually ſmaller towards the end fartheſt from e baſe, or are nearly conical, by which the rface of their ſides divides the preſſure made n the baſes, to prevent the ſoft parts, which e at the ſmall points of the ſockets, to be rt by ſuch preſſure.——At the place where e baſe ends, and the roots begin, there is ge-rally a ſmall circular depreſſion, which ſome ll the *neck* or *collar*.

Without the gums the teeth are covered ith no membrane, and they are ſaid to have proper *perioſteum* within the ſockets ; but at is ſupplied by the reflected membrane of e gums ; which, after a good injection, may evidently ſeen in a young ſubject, with the ſſels from it penetrating into the ſubſtance the teeth ; and it may be diſcovered in any oth recently pulled, by macerating it in wa-r (*a*). The adheſion of this membrane to eſe roots is ſtrengthened by the ſmall furrows ſervable on them.

Each tooth is compoſed of its *cortex*, or *e-mel*, and an internal bony ſubſtance. The *rtex* has no cavity or place for marrow ; d is ſo ſolid and hard, that ſaws or files can ith difficulty make impreſſion on it. It is ickeſt upon the baſe, and gradually, as the

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* Corona.

(*a*) Cowper. Anatom. explicat. tab. 92. fig. 7. lit. E.

roots turn ſmaller, becomes thinner, but no proportionally to the difference of the ſize o the baſe and roots.———The fibres of this e namel are all perpendicular to the internal ſub ſtance, and are ſtreight on the baſe, but at th ſides are arched with a convex part toward the roots (*a*); which makes the teeth reſi the compreſſion of any hard body between th jaws, with leſs danger of breaking theſe fibre than if they had been ſituated tranſverſely. Th ſpongy ſockets in which the teeth are place likewiſe ſerve better to prevent ſuch an injur than a more ſolid baſe would have done.—— Notwithſtanding the great hardneſs of this co *tex*, it is waſted by manducation. Hence th ſharp edges of ſome teeth are blunted, an made broad, while the rough ſurfaces of othe are made ſmooth and flat, as people advance i life.

The bony part of the teeth has its fibre running ſtreight, according to the length o the teeth. When it is expoſed to the air, b the breaking or falling off of the hard *corte* it ſoon corrupts. And thence carious teeth a often all hollow within, when a very ſmall ho appears only externally.

The teeth have canals formed in their mi dle, wherein their nerves and blood-veſſels a lodged; which they certainly need, being co ſtantly waſted by the attrition they are ſubje ed to in manducation, and for their furth growth, not only after they firſt appear, b even in adults; as is evident when a tooth tak

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(*a*) Havers Oſteolog. nov. diſc. 1.

ken out : For then the oppoſite one becomes
nger, and thoſe on each ſide of the empty
cket turn broader ; ſo that when the jaws
e brought together, it is ſcarce obſervable
here the tooth is wanting (*a*).

The veſſels are eaſily traced ſo long as they
e in the large canal, but can ſcarce be ob-
ved in their diſtribution from that to the
ſtance of the teeth of adults. Ruyſch (*b*)
wever affirms, that after injection he could
ce the arteries into the hardeſt part of the
th : And Leewenhoek (*c*) ſuſpected the fibres
the *cortex* to be veſſels. In children I have
quently injected the veſſels of the teeth as
as their baſe : And in ſuch as are not intirely
ified, one can with a lucky injection fill ſo
ny veſſels, as to make both the outſide and
ide of the cortical part appear perfectly red.
——This plentiful ſupply of veſſels muſt ex-
ſe the teeth to the ſame diſorders that at-
k other vaſcular parts ; and ſuch teeth as
ve the greateſt number of veſſels, muſt have
moſt numerous chances of being ſeized
h theſe diſeaſes.

Every root of each tooth has ſuch a diſtinct
al, with veſſels and nerves in it. Theſe
als in the teeth with more than one root,
ne nearer each other, as they approach the
e of the tooth ; and at laſt are only ſepa-
ed by very thin plates, which being general-
incompleat, allow a communication of all
the

) Ingraſ. de tumor. cap. 1. p. 24. 25. 26.

) Theſaur. 10 num. 27.

) Arcan. natur. continuat. epiſt. p. 3.

the canals; and frequently one common ca ty only appears within the baſe, in which a pu py ſubſtance compoſed of nerves and veſſels lodged. The condition therefore of the nerv here bears a ſtrong analogy to that of the c taneous nerves which ſerve for the ſenſation touching.

The entry of the canals for theſe veſſels a ſmall hole placed a little to a ſide of the e treme point of each root; ſometimes, eſpec ally in old people, this hole is entirely cloſ up, and conſequently the nerves and bloo veſſels are deſtroyed (*a*).

The teeth are ſeen for a conſiderable ti in form of *mucus* contained in a membran afterwards a thin cortical plate, and ſome fe oſſeous layers appear within the membra with a large cavity filled with *mucus* in t middle; and gradually this exterior ſhell tur thicker, the cavity decreaſes, the quantity *mucus* is leſſened, and this induration procee till all the body is formed; from which t roots are afterwards produced.

In young ſubjects, different *ſtamina* or ru ments of teeth are to be obſerved. Tho next the gums hinder ordinarily the deep ſeated ones from making their way out, wh theſe prevent the former from ſending o roots, or from entering deep into the bo ſockets of the jaws; by which they come be leſs fixed.

Children are ſeldom born with teeth; but two years of age they have twenty; a their number does not increaſe till they are

bo

(*a*) De la Hire Hiſtoire de l'acad, des ſciences, 1699.

ut ſeven years old, when the teeth that firſt
ade their way through the gums are thruſt
t by others that have been formed deeper in
e jaw, and ſome more of the teeth begin to
cover themſelves farther back in the mouth.
out fourteen years of age, ſome more of
e firſt crop are ſhed, and the number is in-
eaſed.——This ſhedding of the teeth is of
od uſe; for if the firſt had remained, they
uld have ſtood at a great diſtance one from
other; becauſe the teeth are too hard in
r outer cruſt, to increaſe ſo faſt as the jaws
Whereas both the ſecond layer, and the
th that come out late, meeting, while they
ſoft, with a conſiderable reſiſtance to their
wth in length, from thoſe ſituated upon
m, neceſſarily come out broad, and fit to
ke that cloſe guard to the mouth †, which
y now form.

The teeth are joined to the ſockets by *gom-*
ſis, and the gums contribute to fix them
e; as is evident by the teeth falling out
en the gums are any way deſtroyed, or
de too ſpongy; as in the *ſcurvy* or *ſaliva-*
s: whence ſome (*a*) claſs this articulation
h the *ſyſſarcoſis*.

The uſes of the teeth are to maſticate our
ent, and to aſſiſt us in the pronunciation
ſeveral letters.

Though the teeth ſo far agree in their ſtruc-
e, yet, becauſe of ſome things wherein they
er, they are generally divided into three
ſes, *viz. inciſores*, *canini*, and *molares*.

The

φραγμος.

) Drake's Anthropolog. book 4. chap. 3.

The *inciſores* * are the four fore-teeth i each jaw, receiving their name from their o fice of cutting our aliment; for which th are excellently adapted, being each formed i to a ſharp-cutting edge at their *baſe*, by th fore-ſide turning inwards there, while they a ſlopped down and hollowed behind †; ſo th they have the form of wedges; and therefo their power of acting muſt be conſiderably i creaſed.———Seeing in the action of the *inci res*, a perpendicular compreſſion is only nec ſary, without any lateral motion, they are n ſo firmly fixed in their ſockets as the oth teeth are, each having only one ſhort ro but that is broader from before backwar than to either ſide, to have the greateſt ſtreng where it is expoſed to the ſtrongeſt force a plied to it (*a*).

The *inciſores* of the upper jaw, eſpecia the two middle ones ‡, are broader and lon generally than thoſe of the under jaw.

In a new born infant, the outer ſhell of t body of theſe teeth is only hardened.——Af wards, when the *ſtamina* of two ſets are for ed, each has its own ſocket, thoſe neareſt the edge of the gums being placed more f ward, and the others are lodged farther b within the jaw-bones.

Ca

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* Γελασῖνοι, τομικοὶ, διχαςῆρες, κτένες, τομεῖς, προ ὀξεῖς, riſorii, quaterii, primi, primores, anteriores, acu

† Ὀλμίσκος.

(*a*) Lettre ſur l'oſteologie, aſcribed to Du Verney.

‡ Duales.

Canini *, from the reſemblance to dogs
ks, are one on each ſide of the *inciſores* in
h jaw.——The two in the upper jaw are
led *eye-teeth*, from the communication of
ves which is ſaid to be betwixt them and
eyes.——The two in the lower jaw are
ned *angular* or *wike teeth*, becauſe they ſup-
t the angles of the mouth.

he *canini* are broader, longer, and ſtronger,
n the *inciſores*.——Their baſes are formed
a ſharp edge, as the *inciſores* are; only
the edge riſes into a point in the middle.—
h of them has generally but one long root,
ſometimes they have two (*a*). The roots
crooked towards the end.——The *canini* of
upper jaw are larger, longer, and with
e crooked roots, than thoſe of the under
——The form of their baſe is fit both for
cing and cutting, and the long crooked root
ach makes it ſecure in the ſocket.

he *canini* of a child are in much the ſame
dition as the *inciſores* are.

he *dentes molares*, or *grinders* †, which
got their name becauſe they grind our
, are generally five in each ſide of each
; in all twenty. Their baſes are broader,
e ſcabrous, and with a thinner cortical ſub-
e, than the other teeth. They have alſo
e roots, and as theſe roots generally diva-
e from each other, the partitions of the
ets between them bear a large ſhare of the
great

υνὸδοντες, riſorii, fractorii, collaterales, collumellares.
Fauchard, Chirurgien dentiſte, chap 1.
Μυλιται, γόμφοι, μύλοι, πλατεῖς, φραςῆρες, maxillares,
les, clavales, buccarum,

great preſſure they ſuffer, and hinder it to on their points (*a*).

The baſe of the firſt grinder has an ed pointed in the middle, on its outſide, reſe bling the *canini*; from which it ſlops inwa till it riſes again into a point.——It has ge rally but one root, which ſometimes is lo and crooked at its point.

The ſecond *dens molaris* has two points its baſe, riſing near equally on its out and ſide.——It has two roots, either ſeparate run together, but ſhorter than the root of firſt.——Theſe two anterior grinders are mu ſmaller than the three that are placed fart back in the mouth.

The third and fourth are very broad in th baſes, with four or five points ſtanding o and they have three or more roots.

The fifth, called commonly *dens ſapienti* from its coming through the gums later t the other grinders, has four points on its b which is not ſo large as the baſe of the t and fourth, and its roots are leſs numerous

The *inciſores* of the upper jaw, being bro than thoſe of the lower jaw, make the fi rior grinders to be placed ſo much farther b than the lower ones, that when they are brou together, by ſhutting the mouth, the poin the grinders of the one jaw enter into the preſſions of the oppoſite grinders, and they all equally applied to each other, notwithſta ing the inequality of their ſurface.

(*a*) Lettre ſur l'oſteologie.

* Σωφρονιστῆρες, κραντῆρες, ὀψίγονοι, ſenſus, intelle rotini, ætatem complentes, genuini, moderatores,

The numerous roots of the *dentes molares* revent their looſening by the lateral preſſure hey ſuffer in grinding; and as the ſockets in ie upper jaw are more ſpongy, and the teeth re more liable, by their ſituation, to fall out a), the grinders there have more numerous nd more ſeparated roots than in the lower w (*b*). The number however of the roots f the teeth of both jaws is very uncertain; metimes they are more, ſometimes fewer; equently ſeveral roots are joined together; at her times they are all diſtinct. The diſpoſi- on of ſuch as are diſtinct is alſo various; for ſome the roots ſtand out ſtreight, in others ey ſeparate, and in others again they are ooked inwards. When the roots are united, e can ſtill diſtinguiſh them, by remarking the mber of ſmall holes at their points, which termine the number of roots each tooth ght to be reckoned to have.

At the time of birth, only two *dentes lares* in each jaw have begun to oſſify, and at at little more than the baſe, which has ſe- ral ſharp points ſtanding out from it.—The mporaneous grinders are placed more direct- upon the internal ſet than the other two aſſes are; ſometimes there is a piece of the ne of the jaws between the two ſets; in o- er children, the two ſets have no bone inter- ſed between them.

From what has been ſaid, the anſwers to the llowing queries may be given.

O Why

(*a*) Galen. de oſſib. cap. 5.

(*b*) Fauchard, Chirurg. dent. chap. 1.

Why are children ſubject to ſalivation, fever, convulſion, vomiting, purging, &c. whe their teeth are breeding or cutting the gums.

Why in children do the *dentes inciſores* fir cut the gums, the *canini* next, and *molare* laſt ?

Why do children ſhed their teeth ?

Wherefore have theſe *temporaneous* teeth generally no roots, or very ſmall ones ?

Why have theſe firſt teeth ſometimes root and that more frequently in teeth pulled b art than in thoſe which are ſhedded by natu (*a*) ?

Why do theſe roots frequently come ou wards through the gums ?

Whence come *butter* or *buck* teeth ?

How do theſe teeth ſometimes go into th natural row with the others, after pulling a ro ten tooth near them ?

How have ſome people got two rows of tee in one or both jaws (*b*) ?

Why do the teeth of old people looſen, an then drop out entire ?

Whence ariſe the new ſets of teeth whic ſeveral old people obtain (*c*) ?

Why are not the gums of toothleſs old people torn by the hard ſockets in chewing ?

Why are the teeth inſenſible when ſlight filed or raſped ?

How come they to be ſenſible of heat cold, to be ſet on edge by acids, or to gi

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(*a*) Fauchard. Chirurgien dentiſte. p. 7.

(*b*) Blaſ. Comment. ad Veſling. Syntagm. cap. 1. 3

(*c*) Hoffman. in Van. Horn. microcoſm, p. 38.

n uneaſy ſenſation when gritty or ſandy ſub-ances are rubbed between them?

Why does a perſon who has a pained tooth magine it longer than any other?

What is the reaſon of ſome perſons dying onvulſed, upon raſping or filing down an over-rown tooth (*a*)?

How do the teeth break and moulder away ithout any pain in ſome people and not in o-ers?

What parts are affected in the tooth-ach?

What are the cauſes of the tooth-ach?

May worms be reckoned among theſe cauſes)?

Why are the *dentes molares* moſt ſubject to at diſeaſe?

In what different manners ought the ſeveral aſſes of teeth to be extracted when ſuch an peration is neceſſary?

Whence proceeds the violent obſtinate *he-orrhagy* which ſometimes attends the drawing f teeth (*c*)?

Why is it more difficult and dangerous to aw the eye-teeth than any other?

What makes it impoſſible frequently to draw *inders* without bringing away part of the w-bone with them, or breaking the fangs?

(*a*) Bartholin. Anat. reformat. lib. 4. cap. 12.

(*b*) Jacob. in Act. Hafn. vol. 5. obſ. 107.—Pechlin. Ob-v. medic. lib. 2. obſ. 36.—Bartholin. Hiſt. medic cent. 3. ſt. 96.

(*c*) Pare. livre 6 chap. 2.——Rolfinc. lib. 2. cap. 27. & o.—— Moebii Fundam. medicin. cap. 9.—Ephemerid. Ger-an. dec. 1. ann. 3. obſ. 319. ———— Fauchard. Chirurg. nt ſte, tom. 1. chap. 23. obſerv. 7.

Why do teeth ſoon replaced after being ex tracted, become again fixed in the ſockets (a)

According to the diviſion made of the ſkele ton, we ſhould now proceed to the deſcriptio of the trunk of the body. But muſt firſt con ſider a bone, which cannot well be ſaid to belon to either the head or the trunk; nor is it im mediately joined to any other, and therefore i very ſeldom preſerved with ſkeletons. Ho ever, it is generally deſcribed by authors afte the bones of the face: In obedience therefor to the prevailing method, I ſhall next examin the ſtructure of

The *OS HYOIDES**, which is ſituate horizontally between the root of the tongu and the *larynx*. It is properly enough name *hyoides*, from the reſemblance it bears to th *Greek* letter υ, and may, for a clearer demon ſtration of its ſtructure, be diſtinguiſhed into i *body*, *cornua*, and *appendices*.

The body is the middle broad part, conve before, and hollow behind.——The conve fore-part is divided into two, by a ridge, i to the middle of which the *mylo-hyoidei*, an into the ſides the *ſtylo-hyoidei*, muſcles are i ſerted.—— Above the ridge, the bone is ho rizontal, but pitted in the middle by the i ſertion of the two *genio-hyoidei* muſcles, an a little hollowed more laterally by the *baſi gloſſi*.——Below the ridge, it is convex, but litt tle flatted in the middle by the *ſterno hyoidei*, d pitted more externally by the *coraco-hyoi-* *i.*——The concavity behind faces backwards d downwards to receive the *thyroid* cartilage, hen the *larynx* and the *os hyoides* are pulled wards each other by the action of the *ſterno-* *oidei* and *hyothyroidei* muſcles ; and to its up- r edge, the ligamentous membranes of the *iglottis*, tongue, and *thyroid* cartilage, are xed.

(a) De la Motte Chirurgie, tom. 1. chap. 4. obſ. 2.—— Fauchard, Chirurgien dentiſte, tom. 1. chap. 29.

* Hypſyloides Lambdoides, παραστάτη, φαρυγγετρον, gutturis, os linguæ, os morſus Adami, aſſeſſor, os lau bicorne.

The *cornua* of the * *os hyoides* are ſtretched ckwards from each ſide of its body, where ten a ſmall furrow points out the former ſe- ration ; for in young ſubjects, the body and *rnua* are not one continued ſubſtance, as they me afterwards to be in adults.——Theſe *cor-* *a* are not always ſtreight, nor of equal ngth ; their two plain ſurfaces ſtand obliquely pping from above outwards and downwards. —Into the external, the *cerato gloſſus* is in- ted above, and the *thyro-hyoideus* muſcle be- w ; and to the one behind, the ligamentous embrane of the tongue and *larynx* adheres. ch of the *cornua* becomes gradually ſmaller, it is extended from the baſe ; but ends in a und tubercle, from which a moveable carti- ge ſtands out, which is connected to the up- r proceſs of the *cartilago thyroidea*.

Where the body of the *os hyoides* joins on h ſide with its *cornua*, a ſmall ſtyliform ceſs, called *appendix* †, riſes upwards and ckwards, into which the *muſculi ſtylo-hyoidei* *eri*, and part of the *hyo-gloſſi* muſcles are fixed.

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* Crura, latera inferiora.

† Crura ſuperiora, latera ſuperiora, oſſa graniformia.

ed. From each of them a ligament is ſometimes extended to the *ſtyloid* proceſſes of the temporal bones, to keep the *os hyoides* from being drawn too much forewards or downwards The part of this ligament next to theſe proceſſes ſometimes forms into ſeveral cartilages which afterwards oſſify in old people. *Ruyſc* (*a*) ſays that he has ſeen this oſſification continued as far up as the ſtyloid proceſſes, whic were therefore joined to the *os hyoides* by *an chyloſis*.

The ſubſtance of the *os hyoides* is cellula but covered with a firm external plate, whic is of ſufficient ſtrength to bear the actions ſo many muſcles as are inſerted into it.

It is not articulated with any bone of th body, except by means of the muſcles and gaments mentioned.

The uſe of the *os hyoides*, is to ſerve as ſolid lever for the muſcles to act with, in r ſing or depreſſing the tongue and *larynx*, in enlarging and diminiſhing the capacity the *fauces*.

At birth, this bone is in a cartilaginous ſtat excepting a ſmall point of bone in the midd of its body, and in each of the *cornua*.— The *appendices* frequently remain cartilagino many years.

O

(*a*) Adverſ. anat. dec. 3. § 9.

OF THE TRUNK.

HE *TRUNK* conſiſts of the *ſpine*, *pelvis*, and *thorax*.

The *SPINE* * is the long pile of bones ex-ded from the *condyles* of the *occiput* to the l of the rump. It ſomewhat reſembles two equal pyramids joined in a common baſe. It not, however, ſtreight; for its upper part ng drawn backwards by ſtrong muſcles, it dually advances forewards, to ſupport the *œ-hagus*, veſſels of the head, &c. Then it turns kwards, to make place enough for the heart l lungs. It is next bended forewards, to ſup-t the *viſcera* of the *abdomen*. It afterwards ns backwards, for the enlargement of the *vis*. And, laſtly, it is reflected forewards, for aining the loweſt great gut.

The *ſpine* is commonly divided into *true* and *e vertebræ*; the former conſtituting the long per pyramid, which has its baſe below, while *falſe vertebræ* make the ſhorter lower pyra-d, whoſe baſe is above.

The *TRUE VERTEBRÆ* † are the twen-four upper bones of the *ſpine*, on which the eral motions of the trunk of our bodies are rformed; from which uſe they have juſtly t their name.

Each of theſe *vertebræ* is compoſed of its dy and proceſſes.

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* ’Ραχις νωτου ἄκανθα, ἱέρα σύριγξ, σωλην, tergum, ho-nis carina.

† Στροφεῖς, ϛρόφιγγις, ſpondyli, oſſa orbiculata, oſſa verte-ta, verticula.

The body is the thick ſpongy fore-p which is convex before, concave backwar horizontal and plain in moſt of them above a below.——Numerous ſmall holes, eſpecia on the fore and back part of their ſurface, g paſſage to their veſſels, and allow the li ments to enter their ſubſtance.——The ed of the body of each *vertebra* are covered, ſpecially at the fore-part, with a ring of bo firmer and more ſolid than the ſubſtance of body any where elſe. Theſe rings ſeem to joined to the *vertebræ* in the form of *epip ſes*, but are alledged by ſome (*a*) to be the gaments oſſified. They are of great uſe in p venting the ſpongy bodies from being bro in the motions of the trunk.

Between the bodies of each two adjoin *vertebræ*, a ſubſtance between the nature ligament and cartilage is interpoſed; wh ſeems to conſiſt of concentrical curve fib when it is cut horizontally; but when it is vided perpendicularly, the fibres appear lique and decuſſating each other (*b*).—The er part of the intervertebral ligaments is moſt ſolid and hard; and they gradually beco ſofter till they are almoſt in the form o glairy liquor in the center; and theref theſe ſubſtances were not improperly ca *mucous ligaments* by the ancients (*c*). T external fibrous part of each is capable of be greatly extended, and of being compreſſed i

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(*a*) Fallop. Obſervat. anatom.

(*b*) Blancard, Anat. reform. cap. 32.—Weitbrecht, Sy molog. ſect. 4. § 15.

(*c*) Galen. de uſu, part. lib. 12. cap. 16.

ery ſmall ſpace, while the middle fluid
t is incompreſſible, or nearly ſo; and the
ts of this ligament between the circumfe-
ce and center approach in their properties
ither, in proportion to their more ſolid or
e fluid texture. The middle point is
efore a *fulcrum*, or *pivot*, on which the
ion of a ball and ſocket may be made, with
a gradual yielding of the ſubſtance of the
ment, in which ever direction our ſpines
moved, as ſaves the body from violent
ks, and their dangerous conſequences (*c*).

This ligamento-cartilaginous ſubſtance is
y fixed to the horizontal ſurfaces of the
ies of the *vertebræ*, to connect them, in
h it is aſſiſted by a ſtrong membranous li-
ent, which lines all their concave ſurface,
by ſtill a ſtronger ligament that covers all
anterior convex ſurface.

e may lay it down as a general rule, not-
ſtanding ſome exceptions, That the *bodies*
he *vertebræ* are ſmaller, and more ſolid a-
, but as they deſcend, they appear larger
more ſpongy; and that the cartilages be-
n them are thick, and the ſurrounding li-
ents ſtrong in proportion to the largeneſs
e *vertebræ*, and to the quantity of motion
perform: By which diſpoſition, the great-
eight is ſupported on the broadeſt beſt ſe-
d baſe, and the middle of our body is al-
d a large and ſecure motion.

om each ſide of the body of each *verte-*
a bony bridge is produced backwards, and
ſide; from the poſterior end of which, one
ſlanting,

Medical eſſays and obſerv. vol. 5, art. 28.

ſlanting proceſs riſes and another deſcends;
ſmouth, and what is generally the flatteſt
of each of theſe four proceſſes, which are cal
the *oblique**, is covered with a ſmooth ca
lage; and the two lower ones of each *verte*
are fitted to, and articulated with the two up
or aſcending oblique proceſſes of the *vertebra*
low, having their articular ligaments fixed
to the rough line round their edges.

From between the oblique proceſſes of e
ſide the *vertebra* is ſtretched out laterally
to a proceſs that is named *tranſverſe*.

From the back-part of the roots of the
oblique, and of the tranſverſe proceſs of e
ſide, a broad oblique bony plate is exte
backwards, where theſe meet, the ſeventh
ceſs of the *vertebræ* takes its riſe, and ſt
out backwards: This being generally ſ
pointed and narrow edged, has therefore b
called *ſpinal* proceſs; from which this w
chain of bones has got its name.

Beſides the common ligament which line
the internal ſurface of the ſpinal proceſſes
well as of the bodies, there are particula
gaments that connect the bony bridges and
ceſſes of the contiguous *vertebræ* together.

The ſubſtance of the proceſſes is conſi
bly ſtronger and firmer, and has a thicker ex
nal plate than the bodies of the *vertebra* ha

The ſeven proceſſes form a concavit
their fore-part, which, joined to the on
the back-part of the bodies, makes a great h
and the holes of all the *vertebræ* form a

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* Articulatorii, minimi.

conduit *, for containing the *ſpinal mar-*
——In the upper and lower edge of each
al bridge, there is a notch. Theſe are ſo
ted to each other in the contiguous *verte-*
as to form a round hole in each ſide be-
n each two *vertebræ,* through which the
es that proceed from the *ſpinal* marrow
its blood-veſſels paſs.

he articulations then of theſe *true vertebrae*
lainly double; for their bodies are joined
he intervening cartilage above deſcribed,
heir oblique proceſſes being tipped with
lages, are ſo connected by their liga-
s, as to allow a ſmall degree of motion
l ſides. Hence it is evident, that their
r of motion is altered in different poſitions
e trunk: For when we bow forewards,
pper moved part bears entirely on the bo-
of the *vertebrae*: If we bend back, the ob-
proceſſes ſupport the weight: If we re-
to one ſide, we reſt upon the oblique
eſſes of that ſide and part of the bodies:
e ſtand erect, all the bodies and oblique
eſſes have their ſhare in our ſupport.

nce it follows, 1. That becauſe the joints
hich the ſpine is compoſed are ſo nume-
the *ſpinal* marrow, nerves, blood-veſſels,
re not liable to ſuch compreſſion and o-
retching in the motion of the trunk of
ody, as they would otherwiſe be, ſince ſe-
vertebrae muſt be concerned in every mo-
of the ſpine; and therefore a very ſmall
ture is made at the conjunction of any
two

ρα συριγξ, σωλήν, Canalis.

two *vertebrae* (*a*). 2. That an erect poſtur
the ſureſt and firmeſt, becauſe the ſurface
contact of the *fulcra* is largeſt, and the wei
is moſt perpendicular to them (*b*). 3. That
muſcles which move the ſpine act with gre
er force in bringing the trunk to an erect
ſture, than in drawing it to any other : for
bending forewards, backwards, or to a ſide,
muſcles which perform any of theſe acti
are nearer the center of motion ; conſequ
the lever with which they act is ſhorter,
when the center of motion is on the part
the *vertebra*, oppoſite to that where theſe
cles are inſerted ; which is the caſe in mi
the trunk. This is extremely neceſſary;
in the deflections of the ſpine from a perp
dicular bearing, the weight of the body
inclines it which way we deſign ; whereas
raiſing us erect, this great weight muſt
more than counteracted. 4. In calculating
force exerted by the muſcles which move
ſpine, we ſhould always make allowance
the action of the cartilages between the
tebrae, which, in every motion from an
poſture, muſt be ſtretched on one ſide,
compreſſed on the other, to both which
reſiſt; whereas, in raiſing the trunk,
cartilages aſſiſt by their ſpringy force (*c*).
We are hence naturally led into the reaſo
our heighth of ſtature increaſing in the

(*a*) Galen de uſu part. lib. 12. cap. 12.
(*b*) Paaw de oſſib. part. 2. cap. 2.
(*c*) Borelli, de motu animal. pars 1. ſchol. ad prop
Parent. Hiſtoire de l'acad. des ſciences, 1702.

ng, and diminiſhing at night (*a*): for the in-
ermediate cartilages of the *vertebrae* being
reſſed all day long by the weight of our bo-
ly, become more compact and thin in the e-
ening; but when they are relieved from this
reſſure in the night, they again expand them-
elves to their former thickneſs; and ſeeing
he bulk of any part muſt vary according to
he different diſtenſion or repletion of the veſ-
els compoſing it, we may underſtand how we
ecome taller after a plentiful meal, and de-
reaſe after faſting or evacuations (*b*). 6.
rom the different articulations of the bodies,
nd oblique proceſſes of the *vertebrae*, and the
ifferent ſtrength of the ligaments, it is plain,
at they are formed ſo as to allow much larger
otion forewards than backwards; this laſt be-
g of much leſs uſe, and might be dangerous,
y overſtretching the large blood-veſſels that
e contiguous to the bodies of the *vertebrae*
). 7. The intervertebral cartilages ſhrivel-
ng as they become more ſolid by age, is the
uſe why old people generally bow forewards,
d cannot raiſe their bodies to ſuch an erect
ſture as they had in their youth.

The *true vertebrae* ſerve to give us an erect
ſture; to allow ſufficient and ſecure motion
the head, neck, and trunk of the body,
d to ſupport and defend the bowels, and o-
er ſoft parts.

At the ordinary time of birth, each *verte-*
a conſiſts of three bony pieces, connected by

(*a*) Waſſe Philoſoph. tranſact. numb. 383. art. 1.

(*b*) Abbe Fontenu Hiſtoire de l'acad. des ſciences 1725.

(*c*) Galen. de uſu part. lib. 1. cap. 16.

cartilages ; to wit, the *body*, which is not ful
ly oſſified, and a long crooked bone on eac
ſide ; on which we ſee a ſmall ſhare of th
bony bridge, the oblique proceſſes compleat
the beginning tranſverſe proceſſes, and the ob
lique plate, but no ſpinal proceſſes, ſo that th
teguments are in no danger of being hurt b
the ſharp ends of theſe ſpinal proceſſes ; whil
a child is in its bended poſture in the wom
nor while it is ſqueezed in the birth.

From this general mechaniſm of the ſpin
an account is eaſily deduced of all the differen
preternatural curvatures which the ſpine is ca
pable of: for if one or more *vertebra*, o
their cartilages, are of unequal thickneſs i
oppoſite ſides, the ſpine muſt be reclined ove
to the thinner ſide ; which now ſuſtaining th
greateſt ſhare of the weight, muſt ſtill b
more compreſſed, conſequently hindered fro
extending itſelf in proportion to the other ſid
which, being too much freed of its burde
has liberty to enjoy a luxuriant growth. Th
cauſes on which ſuch an inequality of thick
neſs in different ſides of the *vertebrae* depen
may vary : for either it may be owing to
over-diſtenſion of the veſſels of one ſide, an
from thence a preternatural increaſe of th
thickneſs of that part ; or which more com
monly is the caſe, it may proceed from
obſtruction of the veſſels, by which the app
cation of proper nouriſhment to the bony ſu
ſtance is hindered, whether that obſtructio
depends on the faulty diſpoſition of the veſſe
or fluids ; or if it is produced by an unequ
mechanical preſſure, occaſioned by a paralyt

weal

eakneſs of the muſcles and ligaments, or by
ſpaſmodic over-action of the muſcles on any
le of the ſpine, or by people continuing
ng, or putting themſelves frequently into any
ſture declining frpm the erect one: In all
eſe caſes one common effect follows, to wit;
e *vertebrae*, or their cartilages, or both, turn
ick on that ſide where the veſſels are free,
d remain thin on the other ſide where the
ſſels are ſtraitened or obſtructed.——When-
er any morbid curvature is thus made, a ſe-
nd turn, but in an oppoſite direction to the
rmer, muſt be formed; both becauſe the
uſcles on the convex ſide of the ſpine being
etched, muſt have a ſtronger natural con-
ction to draw the parts to which their ends
fixed, and becauſe the patient makes ef-
ts to keep the center of gravity of the bo-
perpendicular to its baſe, that the muſcles
y be relieved from a conſtant violent con-
ctile ſtate, which always creates uneaſineſs
d pain.

When once we underſtand how theſe crook-
ſpines are produced, there is little difficul-
in forming a juſt prognoſis; and a proper
thod of cure may be eaſily contrived, which
uſt vary as to the internal medicines, accor-
ng to the different cauſes on which the diſ-
ſe depends: But one general indication muſt
purſued by ſurgeons; which is, to counteract
bending force, by increaſing the compreſ-
n on the convex part of the curvature, and
miniſhing it on the concave ſide. The man-
r of executing which in particular caſes muſt
different, and requires a very accurate exa-

mination of the circumſtances both of the di eaſe and patient. In many ſuch caſes, I hav found ſome ſimple directions, as to poſtures i which the patient's body ſhould be kept, o very great advantage.

Though the *true vertebræ* agree in the g neral ſtructure which I have hitherto deſcribe yet becauſe of ſeveral ſpecialities proper to particular number, they are commonly divide into three claſſes, *viz. cervical*, *dorſal*, a *lumbar*.

The *cervical* * are the ſeven uppermoſt *ve tebrae*; which are diſtinguiſhed from the reſt b theſe marks.——Their bodies are ſmaller a more ſolid than any others, and flatted on t fore-part, to make way for the *œſophagu* or rather this flat figure is owing to the pre ſure of that pipe, and to the action of t *longi colli* and anterior *recti* muſcles.——Th are alſo flat behind, where ſmall proceſſes ri to which the internal ligaments are fixed.— The upper ſurface of the body of each *ve tebra* is made hollow, by a ſlanting thin proc which is raiſed on each ſide:——The low ſurface is alſo excavated, but in a different ma ner; for here the poſterior edge is raiſed a li tle, and the one before is produced a conſid able way.——Hence we ſee how the carti ges between thoſe bones are firmly connect and their articulations are ſecure.

The cartilages between theſe *vertebrae* a thick, eſpecially at their fore-part; which

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* Τραχηλυ, α'υχὴς, colli.

e reaſon why the *vertebræ* advance foreward they deſcend, and have larger motion.

The oblique proceſſes of theſe bones of the ck more juſtly deſerve that name than oſe of any other *vertebræ*. They are ſitua- d ſlanting; the upper ones having their ſmooth d almoſt flat ſurfaces facing obliquely back- ards and upwards, while the inferior oblique oceſſes have theſe ſurfaces facing obliquely rewards and downwards.

The tranſverſe proceſſes of theſe *vertebræ* are med in a different manner from thoſe of any her bones of the ſpine: For beſides the mmon tranſverſe proceſs riſing from between e oblique proceſſes of each ſide, there is a ond one that comes out from the ſide of e body of each *vertebra*; and theſe two pro- ſſes, after leaving a circular hole for the paſ- e of the cervical artery and vein, unite, d are conſiderably hollowed at their upper t, with riſing ſides, to protect the nerves t paſs in the hollow; and at laſt each ſide minates in an obtuſe point, for the inſertion muſcles.

The ſpinal proceſſes of theſe cervical bones d nearly ſtreight backwards, are ſhorter n thoſe of any other *vertebræ*, and are fork- or double at their ends; and hence allow a re convenient inſertion to muſcles.

The thick cartilages between the bodies of ſe *cervical vertebræ*, the obliquity of their *que* proceſſes, and the ſhortneſs and horizon- ſituation of their *ſpinal* proceſſes, all con- e to allow them large motion.

The holes between the bony croſs bridges
for the paſſage of the nerves from the *ſpin*
marrow, have their largeſt ſhare formed in th
loweſt of the two *vertebræ*, to which they a
common.

So far moſt of the cervical *vertebrae* agre
but they have ſome particular difference
which oblige us to conſider them ſeparately.

The firſt, from its uſe of ſupporting t
head, has the name of *atlas* *; and is al
called *epiſtrophea*, from the motion it perfor
on the ſecond.

The *atlas*, contrary to all the other *ver*
brae of the ſpine, has no body; but, inſte
of it, there is a bony arch.——In the conv
fore-part of which, a ſmall riſing appea
where the *muſculi longi colli* are inſerted; a
on each ſide of this protuberance, a ſmall cavi
may be obſerved, where the *recti interni mi*
res take their riſe.——The upper and low
parts of the arch are rough and unequal, whe
the ligaments that connect this *vertebra* to t
os occipitis, and to the ſecond *vertebra* are f
ed.——The back-part of the arch is conca
ſmooth, and covered with a cartilage, in a
cent ſubject, to receive the tooth-like proc
of the ſecond *vertebra*.——In a firſt *verte*
from which the ſecond has been ſeparated, t
hollow makes the paſſage for the *ſpinal* marr
to ſeem much larger than it really is:
each ſide of it a ſmall rough ſinuoſity may
remarked, where the ligaments going to
ſides of the tooth-like proceſs of the follow

verte

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* Ἀϛραγαλος.

tebra are faſtened ; and on each ſide, a
ll rough protuberance and depreſſion is ob-
vable, where the tranſverſe ligament, which
ures the tooth-like proceſs in the ſinuoſity,
ixed, and hinders that proceſs from injuring
medulla ſpinalis in the flections of the
d.

The *atlas* has as little ſpinal proceſs as body ;
, inſtead thereof, there is a large bony
h, that the muſcles which paſs over this
tebra at that place might not be hurt in
ending the head. On the back and upper
t of this arch there are two depreſſions,
ere the *recti poſtici minores* take their riſe ;
at the lower part are two other ſinuoſities,
o which the ligaments which connect this
e to the following one are fixed.

The ſuperior oblique proceſſes of this *atlas*
large, oblong, hollow, and more horizon-
than in any other *vertebra*.——They riſe
re in their external than internal brim ; by
ich their articulations with the *condyloid*
ceſſes of the *os occipitis* are firmer.——Un-
the external edge of each of theſe oblique
ceſſes, is the *foſſa*, or deep open channel,
which the vertebral arteries make the circu-
turn, as they are about to enter the great
amen of the occipital bone, and where the
th pair of nerves goes out.——In ſeveral
ies, I have ſeen this *foſſa* covered with bone.
— The inferior oblique proceſſes extending
m within outwards and downwards, are large,
cave, and circular. So that this *vertebra*,
trary to the other ſix, receives the bones

with which it is articulated both above and
low.

The tranſverſe proceſſes here are not mu
hollowed or forked, but are longer and larg
than thoſe of any other *vertebra* of the nec
for the origin and inſertion of ſeveral muſcle
of which thoſe that ſerve to move this *verte*
on the ſecond have a conſiderable lever to
with, becauſe of the diſtance of their inſerti
from the *axis* of revolution.

The hole for the *ſpinal marrow* is larger
this than in any other *vertebra,* not only
account of the *marrow* being largeſt here,
alſo to prevent its being hurt by the motion
this *vertebra* on the ſecond one.——This la
hole, and the long tranſverſe proceſſes, ma
this the broadeſt *vertebra* of the neck.

The *condyles* of the *os occipitis* move fo
wards and backwards in the ſuperior obliq
proceſſes of this *vertebra*; but from the fig
of the bones forming theſe joints, it appea
that very little motion can here be allowed
either ſide; and there muſt be ſtill leſs cir
lar motion.

In new-born children this *vertebra* has o
the two lateral pieces oſſified; the arch, whi
it has at its fore-part inſtead of a body, be
cartilaginous.

The ſecond *vertebra colli* is called *dent*
from the tooth like proceſs on the upper p
of its body. Some authors call it *epiſtroph*
but improperly, ſince this deſignation is o
applicable to the firſt, which moves on this
on an axis.

he body of this *vertebra* is ſomewhat of a
amidal figure, being large, and produced
nwards, eſpecially at its fore-ſide, to enter
a hollow of the *vertebra* below; while
upper part has a ſquare proceſs with a ſmall
t ſtanding out from it. This it is that is i-
ined to reſemble a tooth *, and has given
e to the *vertebra*.——The ſide of this pro-
, on which the hollow of the anterior arch
he firſt *vertebra* plays, is convex, ſmooth,
covered with a cartilage; and it is of the
form behind, for the ligament, which is
nded tranſverſely from one rough protube-
e of the firſt *vertebra* to the other, and is
ilaginous in the middle, to move on it.—
igament likewiſe goes out in an oblique
verſe direction, from each ſide of the *pro-*
s dentatus, to be fixed at its other end to
firſt *vertebra*, and to the occipital bone;
another ligament riſes up from near the
t of the proceſs to the *os occipitis*.

he ſuperior oblique proceſſes of this *ver-*
a dentata are large, circular, very nearly
n horizontal poſition, and ſlightly convex,
e adapted to the inferior oblique proceſſes
e firſt *vertebra*.—A moveable cartilage is
by ſome authors to be interpoſed between
oblique proceſſes of the firſt and ſecond
ebra; but I could never find it.——The
rior oblique proceſſes of this *vertebra den-*
anſwer exactly to the deſcription given of
common to all the cervical *vertebræ*.

The

Conoides, pyrenoides, odontoides.

The tranſverſe proceſſes of the *vertebra d* *tata* are ſhort, very little hollowed at th upper part, and not forked at their ends; a the canals through which the cervical arter paſs, are reflected outwards about the mid ſubſtance of each proceſs; ſo that the cou of theſe veſſels may be directed towards tranſverſe proceſſes of the firſt *vertebra*.—H this curvature of the arteries been made i part ſo moveable as the neck is, while th were not defended by a bone, and fixed to t bone, ſcarce a motion could have been p formed without the utmoſt hazard of comp ſion, and a ſtop put to the courſe of the liqu with all its train of bad conſequences. He we obſerve this ſame mechaniſm ſeveral ti made uſe of, when there is any occaſion fo ſudden curvature of a large artery. This the third remarkable inſtance of it we h ſeen. The firſt was the paſſage of the *caro* through the *temporal* bones; and the ſecond that lately deſcribed in the vertebral arter turning round the oblique proceſſes of the *vertebra*, to come at the great hole of the cipital bone.

The ſpinal proceſs of this *vertebra dentat* thick, ſtrong, and ſhort, to give ſufficient gin to the *muſculi recti majores*, and *obliqui* *feriores*, and to prevent the contuſion of th and other muſcles in pulling the head back.

This ſecond *vertebra* conſiſts, at the bi of four bony pieces: For, beſides the th which I already mentioned as common to the *vertebræ*, the tooth-like proceſs of bone is begun at this time to be oſſified in

dle, and is joined as an appendix to the
y of the bone.———Leſt this appendix be
ded or diſplaced, nurſes ought to keep the
ds of new-born children from falling too far
wards by *ſtay-bands*, or ſome ſuch means,
the muſcles attain ſtrength ſufficient to pre-
that dangerous motion.

hen we are acquainted with the ſtructure
articulations of the firſt and ſecond *verte-*
, and know exactly the ſtrength and con-
ion of their ligaments, there is no difficul-
n underſtanding the motions that are per-
ned upon or by the firſt ; though this ſub-
was formerly matter of hot diſpute among
e of the greateſt anatomiſts (*a*). It is
of my purpoſe at preſent to enter into a
il of the reaſons advanced by either party ;
to explain the fact, as any one may ſee
who will remove the muſcles, which, in a
nt ſubject, hinder the view of theſe two
s, and then will turn the head into all the
rent poſitions it is capable of. The head
then be ſeen to move forewards and back-
ds on the firſt *vertebra*, as was already ſaid,
e the *atlas* performs the *circumgyratio* upon
econd *vertebra* ; the inferior oblique pro-
s of the firſt *vertebra* ſhuffling eaſily in a
lar way on the ſuperior oblique preceſſes
e ſecond, and its body or anterior arch
g a rotation on the tooth-like proceſs,
which the perpendicular ligament that is
from the point of the tooth-like proceſs
e occipital bone is twiſted, while the la-
ligaments that fix the *proceſſus dentatus*
to

See Euſtach. de motu capitis.

to the ſides of the firſt *vertebra*, and to th *occipitis*, are very differently affected; fo one upon the ſide towards which the fa turned by the *circumgyratio*, is much ſhort and lax, while the oppoſite one is ſtretched made tenſe, and yielding at laſt no more, vents the head from turning any further r on this *axis*. So that theſe lateral ligam are the proper *moderators* of the *circumgy* of the head here, which muſt be large ſmaller, as theſe ligaments are weaker ſtronger, longer, or ſhorter, and more or capable of being ſtretched.——Beſides the volution on this *axis*, the firſt *vertebra* move a ſmall way to either ſide; but is vented from moving backwards and forew by its anterior arch, and by the croſs ligam which are both cloſely applied to the tooth proceſs. Motion forewards here would been of very bad conſequence, as it would brought the beginning of the *ſpinal* ma upon the point of the tooth-like proceſs.

The rotatory motion of the head is of uſe to us on many accounts, by allowin to apply quickly our organs of the ſenſes to jects: and the *axis* of rotation was altog proper to be at this place; for if it had be a greater diſtance from the head, the w of the head, if it had at any time been re ved from a perpendicular bearing to the very moveable joint, and thereby had ac red a long lever, would have broke the ments at every turn inconſiderately perform or theſe ligaments muſt have been for much ſtronger than could have been con to ſuch ſmall bones. Neither could this cirlar motion be performed on the firſt *vertebra* thout danger, becauſe the immoveable part the *medulla oblongata* is ſo near, as, at each ge turn, the beginning of the *ſpinal* marw would have been in danger of being twiſted, d of ſuffering by the compreſſion this would ve made on its tender fibrils.

It is neceſſary to obſerve, that the *lateral* or *derator* ligaments confine ſo much the mon of the firſt *vertebra* upon the ſecond, that, ough this joint may ſerve us on ſeveral ocſions, yet we are often obliged to turn our ces farther round, than could be done by is joint alone, without the greateſt danger of iſting the ſpinal marrow too much, and alſo luxating the oblique proceſſes; therefore, large turns of this kind, the rotation is aſed by all the *vertebrae* of the neck and loins; d if this is not ſufficient, we employ moſt of e joints of the lower extremities.——This mbination of a great many joints towards e performance of one motion, is alſo to be ſerved in ſeveral other parts of the body; twithſtanding ſuch motions being generally id to be performed by ſome ſingle joint on.

The third *vertebra* of the neck is by ſome lled *axis*; but this name is applied to it ith much leſs reaſon than to the ſecond.——his third, and the three below, have noing particular in their ſtructure; but all their rts come under the general deſcription forerly given, each of them being larger as they eſcend.

The ſeventh * *vertebra* of the neck is ne to the form of thoſe of the back, having th upper and lower ſurfaces of its body leſs ho low than the others :——The oblique proceſſe are more perpendicular ;——neither ſpinal no tranſverſe proceſſes are forked.—This ſevent and the ſixth *vertebra* of the neck have th hole in each of their tranſverſe proceſſes mor frequently divided by a ſmall croſs bridge, th goes between the cervical vein and artery, tha any of the other *vertebrae*.

The twelve *dorſal* † may be diſtinguiſhe from the other *vertebrae* of the ſpine by th following marks.

Their bodies are of a middle ſize, betwi thoſe of the neck and loins ;——they are mo convex before than either of the other tw ſorts ; and are flatted laterally by the preſſure the ribs, which are inſerted into ſmall caviti formed in their ſides. This flatting on the ſides, which makes the figure of theſe *vert* *brae* almoſt an half oval, is of good uſe; it affords a firm articulation to the ribs, allo the *trachea arteria* to divide at a ſmall angl and the other large veſſels to run ſecure fro the action of the vital organs.——Theſe bodie are more concave behind than any of the oth two claſſes.——Their upper and lower ſurf ces are horizontal.

The cartilages interpoſed between the bodie of theſe *vertebrae* are thinner than in any othe

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* Atlas quibuſdam, maxima, magna vertebra, prominen

† Θωρακος, μεταφρένου, νωτου, ὑποτραχήλιου, antiſterni, p ectoris, tergi.

the *true vertebrae*; and contribute to the
ncavity of the ſpine in the thorax, by being
nneſt at their fore-part.

The *oblique* proceſſes are placed almoſt per-
ndicular; the upper ones ſlanting but a little
ewards, and the lower ones ſlanting as much
kwards.—They have not as much convexi-
or concavity as is worth remarking.——
tween the oblique proceſſes of oppoſite ſides,
eral ſharp proceſſes ſtand out from the upper
lower parts of the plates which join to form
ſpinal proceſs; into theſe ſharp proceſſes
ng ligaments are fixed, for connecting the
tebrae.

The *tranſverſe* proceſſes of the *dorſal verte-*
e are long, thicker at their ends than in the
ddle, and turned obliquely backwards; which
y be owing to the preſſure of the ribs, the
ercles of which are inſerted into a depreſ-
near the end of theſe proceſſes.

he *ſpinal* proceſſes are long, ſmall pointed,
ſloping downwards and backwards; from
r upper and back-part a ridge riſes, which
ceived by a ſmall channel in the fore-part
he ſpinal proceſs immediately above, which
ere connected to it by a ligament.

he *conduit* of the *ſpinal* marrow is here
e circular, but, correſponding to the ſize of
cord, is ſmaller than in any of the other
ebrae, and a larger ſhare of the holes in the
y bridges, for the tranſmiſſion of the nerves,
ormed in the *vertebra* above, than in the
below.

he connection of the *dorſal vertebrae* to
ribs, the thinneſs of their cartilages, the

erect

erect ſituation of the oblique proceſſes, th length, ſloping, and connection of the ſpin proceſſes, all contribute to reſtrain theſe *vert brae* from much motion, which might diſtu the actions of the heart and lungs; and, conſequence of the little motion allowed her the *intervertebral* cartilages ſooner ſhrivel, becoming more ſolid: And therefore, the fi remarkable curvature of the ſpine obſerv as people advance to old age, is in the le ſtretched *vertebrae* of the back; or old peop firſt become round-ſhouldered.

The bodies of the four uppermoſt *dorſal v tebrae* deviate from the rule of the *vertebr* becoming larger as they deſcend; for the f of the four is the largeſt, and the other th below gradually become ſmaller, to allow *trachea* and large veſſels to divide at ſmal angles.

The two uppermoſt *vertebrae* of the ba inſtead of being very prominent forewards, flatted by the action of the *muſculi longi* and *recti majores*.

The proportional ſize of the two little preſſions in the body of each *vertebra* for ceiving the heads of the ribs, ſeems to v in the following manner; the depreſſion the upper edge of each *vertebra* decreaſes far down as the fourth, and after that increa

The tranſverſe proceſſes are longer in e lower *vertebra* to the ſeventh or eighth, their ſmooth ſurfaces, for the tubercles of ribs, facing gradually more downwards; afterwards as they deſcend they become ſhor d the ſmooth ſurfaces are directed more up-ards.

The ſpinous proceſſes of the *vertebrae* of the ck become gradually longer and more ſlant- from the firſt, as far down as the eighth or nth *vertebra*; from which they manifeſtly turn orter and more erect.

The firſt[*] *vertebra*, beſides an oblong hollow its lower edge, that aſſiſts in forming the vity wherein the ſecond rib is received, has whole cavity for the head of the firſt rib rmed in it.

The ſecond has the name of *axillary*[†], thout any thing particular in its ſtructure.

The eleventh[‡] often has the whole cavity r the eleventh rib in its body, and wants the ooth ſurface on each tranſverſe proceſs.

The twelfth[‖] always receives the whole ad of the laſt rib, and has no ſmooth ſur-ce on its tranſverſe proceſſes, which are very ort.——The ſmooth ſurfaces of its inferior lique proceſſes face outwards as the *lumbar* .——And we may ſay, in general, that the per *vertebrae* of the back loſe gradually their ſemblance to thoſe of the neck, and the wer ones come nearer to the figure of the *nbar.*

The articulation of the *vertebrae* of the back th the ribs, ſhall be more particularly conſi-red after the ribs are deſcribed. Only it

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[*] Λοφία, gutturalis.

[†] Μασχαλιϛὴρ

[‡] Ἀῤῥεπὴς, in neutram partem inclinans.

[‖] Διαζωϛὴρ, præcingens.

may be proper now to remark, that the lig
ments which ſerve that articulation aſſiſt i
connecting the *vertebrae*.

The loweſt order of the *true vertebrae* is th
lumbar *, which are five bones, that may b
diſtinguiſhed from any others by theſe marks
1. Their bodies, though of a circular form
their fore-part, are ſomewhat oblong fro
one ſide to the other; which may be occaſio
ed by the preſſure of the large veſſels, the *ao*
ta and *cava*, and of the *viſcera*. The *epiph*
ſes on their edges are larger, and therefore th
upper and lower ſurfaces of their bodies a
more concave than in the *vertebrae* of th
back. 2. The cartilages between theſe *ve*
tebrae are much the thickeſt of any, and re
der the ſpine convex within the *abdomen*, b
their greateſt thickneſs being at their for
part. 3. The oblique proceſſes are ſtrong a
deep; thoſe in oppoſite ſides being almo
placed in parallel planes; the ſuperior, whi
are concave, facing inwards, and the conv
inferior ones facing outwards: and therefo
each of theſe *vertebrae* receives the one abo
it, and is received by the one below; whi
is not ſo evident in the other two claſſes alrea
deſcribed. 4. Their tranſverſe proceſſes a
ſmall, long, and almoſt erect, for allowi
large motion to each bone, and ſufficient i
ſertion to muſcles, and for ſupporting and d
fending the internal parts. 5. Betwixt th
roots of the ſuperior oblique and tranſver
proceſſes, a ſmall protuberance may be obſerve
whe

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* Οσφύος' ἰξύος, ψοιῶν. renum, lumborum.

ere ſome of the muſcles that raiſe the trunk the body are inſerted. 6 Their ſpinal pro- ſſes are ſtrong, ſtreight, and horizontal, with oad flat ſides, and a narrow edge above and ow; this laſt being depreſſed on each ſide muſcles. And at the root of theſe edges, ſee rough ſurfaces for fixing the ligaments. The canal for the numerous cords, called da equina, into which the ſpinal marrow di- es, is rather larger in theſe bones than at contains that *marrow* in the *vertebræ* the back. 8. The holes for the paſſage of nerves are more equally formed out of h the contiguous *vertebrae* than in the er claſſes; the upper one furniſhes how- r the larger ſhare of each hole.

he thick cartilages between theſe *lumbar tebrae*, their deep oblique proceſſes, and their ſt ſpinal proceſſes, are all fit for allowing e motion; though it is not ſo great as t is performed in the neck; which appears n comparing the arches which the head de- bes when moving on the neck, or the loins y.

he *lumbar vertebrae* as they deſcend, have r oblique proceſſes at a greater diſtance n each other, and facing more backwards forewards.

oth tranſverſe and ſpinal proceſſes of the dlemoſt *vertebrae* of the loins are longeſt thickeſt; in the *vertebrae* above and below are leſs: So that theſe proceſſes of the firſt * and

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Νεφριτης, renalis.

and fifth [*] are the leaſt, to prevent their ſtr
king on the ribs or *oſſa ilium*, or their bruiſi
the muſcles in the motions of the ſpine.

The *epiphyſes* round the edges of the b
dies of the *lumbar vertebrae* are moſt raiſed in t
two loweſt, which conſequently make them a
pear hollower in the middle than the others a

The body of the fifth *vertebra* is rath
thinner than that of the fourth.——The ſpi
proceſs of this fifth is ſmaller, and the obliq
proceſſes face more backwards and forewa
than in any other *lumbar vertebra*.

After conſidering the ſtructure of the par
cular *vertebræ*, and their mutual connecti
we may obſerve a ſolicitous care taken that t
ſhall not be disjoined, but with great difficul
for beſides being connected by ſtrong li
ments proportioned to the forces which are
be reſiſted, their bodies either enter ſo i
each other, as to prevent their being diſpla
any way, as in the *vertebrae* of the neck;
they are proped on all ſides, as theſe of the b
are by the ribs; or their ſurfaces of con
are ſo broad, as to render the ſeparation
moſt impracticable, as in the *loins*; while
depth and articulation of the oblique proce
are exactly proportioned to the quantity
motion which the other parts of the bones
low, or the muſcles can perform: Yet,
theſe oblique proceſſes are ſmall, and the
fore not capable of ſo ſecure a conjunct
as the larger bodies, they may ſooner yield
a disjoining force; but then their diſlocat

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[*] Ασχαλίτης, fulciens.

not of near ſo bad conſequence as the ſepa-ion of the bodies would be. For, by the ique proceſſes being diſlocated, the muſcles, ments, and *ſpinal* marrow are indeed tched; but this marrow muſt be compreſſed, entirely deſtroyed, when the body of the *tebra* is removed out of its place.

The *FALSE VERTEBRÆ* compoſe under pyramid of the *ſpine*. They are diſ-guiſhed from the bones already deſcribed ly enough by this epithet of *falſe*; becauſe ' each bone into which they can be divided young people, reſembles the *true vertebrae* figure, yet none of them contribute to the tion of the trunk of the body; they being mately united to each other in adults, ex-t at their lower part, where they are move-e; whence they are commonly divided into bones, *os ſacrum*, and *coccygis*.

S SACRUM *, is ſo called, from being red in ſacrifice by the ancients, or rather auſe of its largeneſs in reſpect of the other *tebrae.*——This bone is of an irregular trian-ar ſhape, broad above, narrow below, con-behind, for the advantageous origin of the ſcles that move the *ſpine* and thigh back-rds; and concave behind, for enlarging the ity of the *pelvis.*———Four tranſverſe lines a colour different from the reſt of the bone ich are ſeen on its fore-part, are the marks diviſion of the five different bones of which onſiſts in young perſons.

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* Ἱερὸν, σπονδυλος μεγας Hippocrat. ὑποσπονδυλον, ori-
Πλατυ, latum, os clunium, clavium.

The fore-part of the *os ſacrum*, analogous the bodies of the *true vertebræ*, is ſmooth flat, to allow a larger ſpace for the contai bowels, without any danger of hurting the or this flat figure may be owing to the eq preſſure of theſe bowels, particularly of the gut.——The back-part of it is almoſt ſtrei without ſo large a cavity as the *vertebræ* ha becauſe the ſpinal marrow, now ſeparated i the *cauda equina*, is ſmall.——The bridges tween the bodies and proceſſes of this bone, much thicker, and in proportion ſhorter, t in the former claſs of bones.——The ſtren of theſe croſs bridges is very remarkable in three upper bones, and is well proportio to the incumbent weight of the trunk of body, which theſe bridges ſuſtain in a tranſve conſequently an unfavourable, ſituation, w the body is erect.

There are only two oblique proceſſes of *os ſacrum*; one ſtanding out on each ſide fr the upper part of the firſt bone.——Their p erect ſurfaces face backwards, and are art lated with the inferior oblique proceſſes of laſt *vertebra* of the loins, to which each theſe proceſſes is connected by a ſtrong l ment, which riſes from a ſcabrous ca round their roots, where mucilaginous gla are alſo lodged.—Inſtead of the other obli proceſſes of this bone, four rough tuber are to be ſeen on each ſide of its ſurface hind, from which the *muſculus ſacer* has origin.

The tranſverſe proceſſes here are all gro together into one large ſtrong oblong pro

ach ſide; which ſo far as it anſwers to the
three bones, is very thick, and divided
two irregular cavities, by a long perpendi-
r ridge.——The foremoſt of the two ca-
s has commonly a thin cartilaginous ſkin
ring it in the recent ſubject, and is adapt-
o the unequal protuberance of the *os ilium*,
a ſtrong ligament connects the circum-
ce of theſe ſurfaces of the two bones.—
cavity behind is divided by a tranſverſe ridge
two, where ſtrong ligamentous ſtrings that
om this bone to the *os ilium* with a cellu-
bſtance containing *mucus*, are lodged.

he tranſverſe proceſſes of the two laſt bones
e *os ſacrum* are much ſmaller than the
er.——At their back-part near their edge,
ob and oblong flat ſurface give riſe to two
g ligaments which are extended to the *os*
m; and are therefore called *ſacroſciatic*.

e ſpinal proceſſes of the three uppermoſt
of the *os ſacrum* appear ſhort, ſharp, and
t erect, while the two lower ones are
behind; and ſometimes a little knob is to
en on the fourth, though generally it is
cated, without the two legs meeting in-
pine; in which condition alſo the firſt is
to be ſeen; and ſometimes none of them
but leave a *ſinus*, or rather *foſſa*, in-
of a canal (*a*).—The *muſculus latiſſimus*
ngiſſimus dorſi, *ſacrolumbalis*, and *glutaeus*
mus, have part of their origins from theſe
proceſſes.

The

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erheyen, Anat. tract. 5. cap. 9.——Sue Trad. d'oſteol.

The canal between the bodies and proc
of this bone, for the *cauda equina,* is tria
lar; and becomes ſmaller as it deſcends, as
cauda alſo does.——Below the third bone,
paſſage is no more a compleat bony canal,
is open behind; and is only there defende
a ſtrong ligamentous membrane ſtretched
it, which, with the muſcles that cover it,
are very prominent on each ſide, is a ſuffi
defence for the bundle of nerves within.

At the root of each oblique proceſs of
bone, the notch is conſpicuous, by which,
ſuch another in the laſt *vertebra* of the l
a paſſage is left for the twenty-fourth ſ
nerve; and, in viewing the *os ſacrum,* e
before or behind, four large holes appe
each ſide, in much the ſame height, as w
the marks of the union of its ſeveral bone
main. Some of the largeſt nerves of the
paſs through the anterior holes; and ſuper
grooves running outwards from them in
ferent directions, ſhew the courſe of
nerves.——From the intervals of theſe gro
the *pyriformis* muſcle chiefly riſes.——
holes in the back-part of the bone are co
by membranes which allow ſmall nerves to
through them.——The two uppermoſt of
holes, eſpecially on the fore-ſide, are
largeſt; and as the bone deſcends, the
turn ſmaller. Sometimes a notch is only
ed at the lower part in each ſide of this b
and in other ſubjects there is a hole com
to it and the *os coccygis,* through whic
twenty-ninth pair of ſpinal nerves paſſes
frequently a bony bridge is formed on the

rt of each ſide by a proceſs ſent up from the
ck-part of the *os coccygis*, and joined to the
tle knobs which the laſt bone of the *os ſa-*
um has inſtead of a ſpinal proceſs. Under this
idge or *jugum*, the twenty-ninth pair of ſpi-
l nerves runs in its courſe to the common
les juſt now deſcribed.

The upper part of the body of the firſt bone
ſembles the *vertebrae* of the loins; but the
all fifth bone is oblong tranſverſely, and hol-
w in the middle of its lower ſurface.

The ſubſtance of the *os ſacrum* is very ſpon-
, without any conſiderable ſolid external plates,
d is lighter proportionally to its bulk than
y other bone in the body; but is ſecured
om injuries by the thick muſcles that cover
behind, aud by the ſtrong ligamentous mem-
anes that cloſely adhere to it.——As this is
e of the moſt remarkable inſtances of this
t of defence afforded a ſoft weak bone, we
y make the general obſervation, That,
ere-ever we meet with ſuch a bone, one or
her, or both theſe defences are made uſe of;
firſt to ward off injuries, and the ſecond
keep the ſubſtance of the bone from yield-
too eaſily.

This bone is articulated above to the laſt *ver-*
ra of the loins, in the manner that the
bar vertebrae are joined; and therefore
ſame motions may be performed here.——
e articulation of the lower part of the *os*
rum to the *os coccygis* ſeems well enough
pted for allowing conſiderable motion to
laſt bone, was it not much confined by
aments. Laterally, the *os ſacrum* is joined

to the *oſſa ilium* by an immoveable *ſynchon drofis*, or what almoſt deſerves the name of ſuture: for the cartilaginous cruſt on the ſu face of the bones is very thin, and both the ſurfaces are ſo ſcabrous and unequal, as to indented into each other; which makes ſuch ſtrong connection, that great force is requir to ſeparate them, after all the muſcles and gaments are cut.——Frequently the two bon grow together in old ſubjects.

The uſes of the *os ſacrum* are, to ſerve the common baſe and ſupport of the trunk the body, to guard the nerves proceeding fro the end of the ſpinal marrow, to defend t back-part of the *pelvis*, and to afford ſufficie origin to the muſcles which move the tru and thigh.

The bones that compoſe the *os ſacrum* of fants, have their bodies ſeparated from each ther by a thick cartilage; and, in the ſa manner as the *true vertebrae*, each of them co ſiſts of a body and two lateral plates, conne ed together by cartilages; the ends of t plates ſeldom being contiguous behind.

OS COCCYGIS *, or *rump bone*, is that t angular chain of bones depending from t *os ſacrum*; each bone becoming ſmaller they deſcend, till the laſt ends almoſt in point. The *os coccygis* is convex behind, concave before; from which crooked pyrami figure, which was thought to reſemble a c kow's beak, it has got its name.

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* Ὀῤῥοπύγιον, ὄῤῥος, caudæ os, ſpondylium, os cucu

This bone conſiſts of four pieces in people of
iddle age :———In children, very near the
hole of it is cartilage : In old ſubjects, all the
ones are united, and become frequently one
ntinued bone with the *os ſacrum.*

The higheſt of the four bones is the largeſt,
ith ſhoulders extended farther to each ſide
an the end of the *os ſacrum* ; which enlarge-
ent ſhould, in my opinion, ſerve as a diſtin-
iſhing mark to fix the limits of either bone ;
d therefore ſhould take away all diſpute about
ckoning the number of bones, of which
e or other of theſe two parts of the *falſe*
rtebræ, is compoſed ; which diſpute muſt
ll be kept up, ſo long as the numbering five
ſix bones in the *os ſacrum* depends upon the
certain accident of this broad ſhouldered little
ne being united to or ſeparated from it.——
e upper ſurface of this bone is a little hol-
w.——From the back of that bulbous part
lled its *ſhoulders*, a proceſs often riſes up on
ch ſide, to join with the bifurcated ſpine of
fourth and fifth bones of the *os ſacrum*, to
m the bony bridge mentioned in the de-
iption of the *os ſacrum*.—Sometimes theſe
oulders are joined to the ſides of the fifth
ne of the *os ſacrum*, to form the hole in
ch ſide common to theſe two bones, for the
ſſage of the twenty-ninth pair of ſpinal
rves.——Immediately below the ſhoulders
the *os coccygis*, a notch may be remarked in
ch ſide, where the thirtieth pair of the ſpi-
l nerves paſſes——The lower end of this
ne is formed into a ſmall head, which very
ten is hollow in the middle.

The three lower bones gradually becom ſmaller, and are ſpongy; but are ſtrengthened by a ſtrong ligament which covers an connects them.——Their ends, by which the are articulated, are formed in the ſame manner as thoſe of the firſt bone are.

Between each of theſe four bones of youn ſubjects a cartilage is interpoſed; therefor their articulation is analogous to that of th bodies of the *vertebræ* of the neck: For, a has been above remarked, the lower end of th *os ſacrum*, and of each of the three ſuperio bones of the *os coccygis*, has a ſmall depreſſio in the middle; and the upper part of all th bones of the *os coccygis* is a little concave, an conſequently the interpoſed cartilages are thickeſt in the middle, to fill up both cavities; b which they connect the bones more firmly.— When the cartilages oſſify, the upper end o each bone is formed into a cavity, exactly adapted to the protuberant lower end of th bone immediately above.—From this ſort o articulation, it is evident, that, unleſs whe theſe bones grow together, all of them are c pable of motion; of which, the firſt and ſecond eſpecially this laſt, enjoys the largeſt ſhare.

The lower end of the fourth bone terminat in a rough point, to which a cartilage is a pended.

To the ſides of theſe bones of the *os coccy gis*, the *coccygæi* muſcles (*a*), and part of th *levatores ani*, and of the *glutæi maximi*, ar fixed.

Th

(*a*) Douglas, Myograph. chap. 40.——Euſtach. tab. 3 No. 45. 20.

The ſubſtance of theſe bones is very ſpongy, d in children cartilaginous: there being only part of the firſt bone oſſified in a new-born fant.—Since therefore the *inteſtinum rectum* children is not ſo firmly ſupported as it is *adults*, this may be one reaſon why they are ore ſubject to a *procidentia ani* than old peo- e (a).

From the deſcription of this bone, we ſee w little it reſembles the *vertebræ*; ſince it dom has proceſſes, never has any cavity for *ſpinal* marrow, nor holes for the paſſage of rves.—Its connection hinders it to be moved either ſide; and its motion backwards and ewards is much confined: Yet, as its liga- nts can be ſtretched by a conſiderable force, is a great advantage in the excretion of *fæces alvinæ*, and much more in child- aring, that this bone ſhould remain move- e; and the right management of it, in de- ring women, may be of great benefit to m (b).——The mobility of the *os coccygis* iniſhing as people advance in age, eſpeci- when its ligaments and cartilages have been kept flexible by being ſtretched, is bably one reaſon why the women, who old maids before they marry, have gene- y hard labour in child-bed.

The *os coccygis* ſerves to ſuſtain the *inteſti- n rectum*; and, in order to perform this of- more effectually, it is made to turn with a curve

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) Spigel. de humani corp. fabric. lib. 2. cap. 22.—— w, de oſſib. par. 2. cap. 3.

) Paaw, ibid.——Deventer, Operat. chirurg. cap. 27.

curve forewards; by which alſo the bone itſel as well as the muſcles and teguments, is pr ſerved from any injury, when we ſit with o body reclined back.

The ſecond part of the trunk of the ſkel ton, the *PELVIS*, is the cylindrical cavi at the lower part of the *abdomen*, formed the *os ſacrum*, *os coccygis*, and *oſſa innomina* which laſt therefore fall now in courſe to examined.

Though the name of *OSSA INNOM* *NATA** contributes nothing to the kno ledge of their ſituation, ſtructure, or offic yet they have been ſo long and univerſa known by it, that there is no occaſion changing it.—They are two large broad bon which form the fore-part and ſides of the *vis*, and the lower part of the ſides of the *domen*—In children each of theſe bones is vidently divided into three; which are af wards ſo intimately united, that ſcarce the l mark of their former ſeparation remains: T notwithſtanding, they are deſcribed as con ing each of three bones, to wit, the *os ili* *iſchium*, and *pubis*; which I ſhall firſt deſc ſeparately, and then ſhall conſider what is c mon to any two of them, or to all the thre

OS ILIUM†, or *haunch-bone*, is ſitu higheſt of the three, and reaches as far d as one third of the great cavity into whic head of the thigh-bone is received.

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* Σκελέων, προσφύσεις, ſacro conjuncta.

† Λαγόνων, κενεών, ſcaplium, lumbare, clunium, c anchas.

The external ſide of this bone is unequally nvex, and is called its *dorſum*; — the inter- l concave ſurface is by ſome (but improper-) named [illegible]*coſta*.——The ſemicircular edge the higheſt part of this bone, which is tip- d with a cartilage in the recent ſubject, is med the *ſpine*, into which the external or ſcending oblique muſcle of the *abdomen* is ſerted; and from it the internal aſcending ob- ue and the tranſverſe muſcles of the belly, th the *glutæus maximus*, *quadratus lumborum*, d *latiſſimus dorſi*, have their origin. Some (*a*), e of opinion, that it is only the tendinous uſt of all theſe muſcles, and not a cartilage, commonly alledged, that covers this bony ge.—The ends of the ſpine are more pro- inent than the ſurface of the bone below em; therefore are reckoned proceſſes.—— om the anterior ſpinal proceſs, the *ſartorius* d *faſcialis* muſcles have their riſe, and the ter end of the doubled tendon of the ex- rnal oblique muſcle of the *abdomen*, com- only called *Fallopius*'s or *Poupart*'s ligament, fixed to it.———The inſide of the poſterior inal proceſs, and of part of the ſpine foreward om that, is made flat and rough where the *ſa- o lumbalis* and *longiſſimus dorſi* riſe; and to outſide ligaments, extended to the *os ſa- um* and tranſverſe proceſſes of the fifth and urth *vertebrae* of the loins, are fixed (*b*).—— low the anterior ſpinal proceſs another pro- tuberance

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(*a*) Winſlow, Expoſition anatomique du corps humain, ité des os frais, § 96.

(*b*) Weitbrecht, Syndeſmolog. ſect. 4. § 39. 40. 46. 47.

tuberance ſtands out, which, by its ſituatio
may be diſtinguiſhed from the former, by add
ing the epithet of *inferior*, where the *muſ*
culus rectus tibiae has its origin (*a*).—Betwix
theſe two anterior proceſſes the bone is hollow
ed where the beginning of the *ſartorius* mu
cle is lodged.——Below the poſterior ſpinal pro
ceſs, a ſecond protuberance of the edge of th
bone is in like manner obſervable, which i
cloſely applied to the *os ſacrum.*——Under th
laſt proceſs a conſiderable large niche is ob
ſervable in the *os ilium*; between the ſides o
which and the ſtrong ligament that is ſtretche
over from the *os ſacrum* to the ſharp-pointe
proceſs of the *os iſchium* of the recent ſubjec
a large hole is formed, through which th
muſculus pyriformis, the great ſciatic nerve, an
the poſterior crural veſſels paſs, and are pro
tected from compreſſion.

The external broad ſide or *dorſum* of th
os ilium is a little hollow towards the for
part; farther back it is as much raiſed; then
conſiderably concave; and, laſtly, it is co
vex. Theſe inequalities are occaſioned by th
actions of the muſcles that are ſituated on th
ſurface.—From behind the uppermoſt of th
two anterior ſpinal proceſſes, in ſuch bones
are ſtrongly marked by the muſcles, a ſem
circular ridge is extended to the hollow pa
ſage of the ſciatic nerve. Between the ſpi
and this ridge, the *glutaeus medius* takes i
riſe. Immediately from above the loweſt
the anterior ſpinal proceſſes, a ſecond rid

(*a*) Baker, Curſ. oſteolog. demonſtr. 3.

tretched to the niche. Between this and
former ridge, the *glutaeus minimus* has its
gin.——On the outſide of the poſterior ſpi-
proceſſes, the *dorſum* of the *os ilium* is
and rough, where part of the *muſculus*
aeus maximus and *pyriformis* riſes.—The
eſt part of this bone is the thickeſt, and is
ned into a large cavity with high brims,
aſſiſt in compoſing the great *acetabulum*;
ch ſhall be conſidered, after all the three
es that conſtitute the *os innominatum* are
ribed.

he internal ſurface of the *os ilium* is con-
e in its broadeſt fore-part, where the in-
al iliac muſcle has its origin, and ſome
e of the *inteſtinum ilium* and *colon* is lod-
——From this large hollow, a ſmall ſinuo-
is continued obliquely forewards, at the in-
of the anterior inferior ſpinal proceſs, where
of the *pſoas* and *iliacus* muſcles, with the
al veſſels and nerves, paſs.——The large
cavity is bounded below by a ſharp ridge,
ch runs from behind forewards; and, being
inued with ſuch another ridge of the *os*
s, forms a line of partition between the
men and *pelvis*.——Into this ridge the
d tendon of the *pſoas parvus* is inſert-

ll the internal ſurface of the *os ilium*, be-
this ridge, is very unequal: For the up-
part is flat, but ſpongy, where the *ſacro-*
alis and *longiſſimus dorſi* riſe.——Lower
n, there is a tranſverſe ridge from which
nents go out to the *os ſacrum*.——Imme-
ly below this ridge, the rough unequal ca-
vities

vities and prominences are placed, which
exactly adapted to thoſe deſcribed on the
of the *os ſacrum.*——In the ſame manner,
upper part of this rough ſurface is porous,
the firmer adheſion of the ligamentous cellu
ſubſtance ; while the lower part is more ſol
and covered with a thin cartilaginous ſkin,
its immoveable articulation with the *os*
crum.——From all the circumference of
large unequal ſurface, ligaments are extend
to the *os ſacrum,* to ſecure more firmly
conjunction of theſe bones.

The paſſages of the medullary veſſels
very conſpicuous, both in the *dorſum* and
of many *oſſa ilium* ; but in others they are
conſiderable.

The poſterior and lower parts of theſe bo
are thick ; but they are generally exceeding
and compact at their middle, where they
expoſed to the actions of the *muſculi glu*
and *iliacus internus,* and to the preſſure of
bowels contained in the belly.——The
ſtance of the *oſſa ilium* is moſtly cellular,
cept a thin external table.

In a ripe child, the ſpine of the *os ilium*
cartilaginous, and is afterwards joined to
bone in form of an *epiphyſe.*——The la
lower end of this bone is not compleately
fied.

*OS ISCHIUM** or *hip bone,* is of a
dle bulk between the two other parts of
os innominatum, is ſituated loweſt of the
and is of a very irregular figure.——Its

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* Coxæ, coxendicis, pixis.

t might be marked by an horizontal line
wn near through the middle of the *acetabu-*
; for the upper bulbous part of this bone
ms ſome leſs than the lower half of that
at cavity, and the ſmall leg of it riſes to
ch the ſame height on the other ſide of the
at hole common to this bone and the *os*
is.

rom the upper thick part of the *os iſchi-*
a ſharp proceſs, called by ſome *ſpinous*, ſtands
backwards, from which chiefly the *muſcu-*
coccygaeus and *ſuperior gemellus*, and part
the *levator ani*, riſe; and the anterior or
rnal *ſacroſciatic* ligament is fixed to it.——
ween the upper part of this ligament and
bones, it was formerly obſerved that the
form muſcle, the poſterior crural veſſels,
the ſciatic nerve, paſs out of the *pelvis*.—
nediately below this proceſs, a ſinuoſity is
ned for the tendon of the *muſculus obtura-*
internus.—In a recent ſubject, this part of
bone, which ſerves as a pully on which
obturator muſcle plays, is covered with a
mentous cartilage, that, by two or three
ll ridges, points out the interſtices of the
s in the tendon of this muſcle.——The
r ſurface of the bone at the root of this
ous proceſs is made hollow by the *pyrifor-*
or *iliacus externus* muſcle.

elow the ſinuoſity for the *obturator*
cle, is the great knob or *tuberoſity*, co-
d with cartilage or tendon (*a*).—— The
er part of the tuberoſity gives riſe to the
inferior

) Winſlow, Expoſit. anat. des os frais, § 96.

inferior *gemellus* muſcle. ——— To a ridge the inſide of this, the external or poſte *ſacroſciatic* ligament is ſo fixed that betw it, the internal ligament, and the ſinuoſity the *os iſchium*, a paſſage is left for the in nal *obturator* muſcle.————The upper th ſmooth part of the *tuber*, called by ſome *dorſum*, has two oblique impreſſions on The inner one gives origin to the long h of the *biceps flexor tibiæ* and *ſeminerv* muſcles, and the *ſemimembranoſus* riſes fr the exterior one, which reaches higher nearer the *acetabulum* than the other.— lower, thinner, more ſcabrous part of the k which bends forewards, is alſo marked with flat ſurfaces, whereof the internal is what lean upon in ſitting, and the external g riſe to the largeſt head of the *triceps addu* *femoris*.———Between the external margi the tuberoſity and the great hole of the *innominatum*, there is frequently an ob ridge extended down from the *acetabu* which gives origin to the *quadratus fem* —As the *tuber* advances forewards, it beco ſmaller, and is rough, for the origin of *muſculus tranſverſalis* and *erector penis*.- The ſmall leg of it, which mounts upw to join the *os pubis*, is rough and promi at its edge, where the two lower heads of *triceps* or *quadriceps adductor femoris* take riſe.

The upper and back part of the *os iſch* is broad and thick; but its lower and f part is narrower and thinner.——Its ſubſt is of the ſtructure common to broad bones

The *os ilium* and *pubis* of the ſame ſide re the only bones which are contiguous to the *s iſchium.*

The part of the *os iſchium* which forms the *cetabulum*, the ſpinous proceſs, the great *tuber*, nd the recurved leg, are all cartilaginous at irth.——The *tuber*, with part of the leg or roceſs above it, becomes an epiphyſe before his bone is fully formed.

The *OS PUBIS**, or *ſhare bone*, is the eaſt of the three parts of the *os innominatum*, nd is placed at the upper fore-part of it.——he thick largeſt part of this bone is employ- d in forming the *acetabulum*; from which ecoming much ſmaller, it is ſtretched inwards o its fellow of the other ſide, where again it rows larger, and ſends a ſmall branch down- ards to join the end of the ſmall leg of the *iſchium.*——The upper fore-part of each *pubis* is tuberous and rough where the *uſculus rectus* and *pyramidalis* are inſerted. ——From this a ridge is extended along the pper edge of the bone, in a continued line ith ſuch another of the *os ilium*, which di- des the *abdomen* and *pelvis*. The ligament *Fallopius* is fixed to the internal end of this dge, and the ſmooth hollow below it is ade by the *pſoas* and *iliacus internus* muſcles aſſing with the anterior crural veſſels and erves behind the ligament.——Some way low the former ridge, another is extended om the tuberous part of the *os pubis* down- ards and outwards towards the *acetabulum*;

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* ἥβης, pectinis, penis, pudibundum, feneſtratum.

between theſe two ridges the bone is hollo and ſmooth, for lodging the head of th *pectineus* muſcle.——Immediately below, wher the lower ridge is to take the turn downwards, a winding nitch is made, which i comprehended in the great *foramen* of a ſkeleton, but is formed into a hole by a ſubtended ligament in the recent ſubject, for the paſſage of the poſterior crural nerve, an artery and a vein.———The internal end of the o *pubis* is rough and unequal, for the firme adheſion of the thick ligamentous cartilag that connects it to its fellow of the other ſide ——The proceſs which goes down from tha to the *os iſchium* is broad and rough before where the *gracilis* and upper heads of the *triceps*, or rather *quadriceps adductor femori* have their origin.

The ſubſtance of the *os pubis* is the ſame a of other broad bones.

Only a part of the large end of this bon is oſſified, and the whole leg is cartilaginous in a child born at the full time.

Betwixt the *os iſchium* and *pubis* a ver large irregular hole is left, which, from i reſemblance to a door or ſhield, has bee called *thyroides*. This hole is all, except th nitch for the poſterior crural nerve, filled u in a recent ſubject with a ſtrong ligamentou membrane, that adheres very firmly to its circumference. From this membrane chiefly th two *obturator* muſcles, external and interna take their riſe.——The great deſign of thi hole, beſides rendering the bone lighter, i to allow a ſtrong enough origin to the *obtura*

to

or muſcles, and ſufficient ſpace for lodging heir bellies, that there may be no danger f diſturbing the functions of the contained iſcera of the *pelvis* by the actions of the in- ernal, nor of the external being bruiſed by he thigh bone, eſpecially by its leſſer *tro- hanter*, in the motions of the thigh inwards: oth which inconveniences muſt have happen- d, had the *oſſa innominata* been compleat here, nd of ſufficient thickneſs and ſtrength to erve as the fixed point of theſe muſcles.—— he bowels ſometimes make their way through he nitch for the veſſels, at the upper part of is *thyroid* hole, and this cauſes a *hernia* in this lace (*a*).

In the external ſurface of the *oſſa innominata*, ear the outſide of the great hole, a large eep cavity is formed by all the three bones onjunctly: For the *os pubis* conſtitutes about ne fifth; the *os ilium* makes ſomething ſs than two fifths, and the *os iſchium* as uch more than two fifths. The brims of is cavity are very high, and are ſtill much ore enlarged by the ligamentous cartilage, ith which they are tipped in a recent ſub- ect. From this form of the cavity it has een called *acetabulum*; and for a diſtinguiſh- g character, the name of the bone that con- itutes the largeſt ſhare of it is added; there- re *acetabulum oſſis iſchii* * is the name this vity commonly bears.———Round the baſe

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(*a*) Memoires de l'acad de chirurgie, tom. 1, p. 709. &c.

* Coxæ, coxendicis.

of the *ſupercilia* the bone is rough and unequal where the *capſular* ligament of the articulation is fixed.———The brims at the upper an back part of the *acetabulum* are much large and higher than any where elſe; which is ver neceſſary to prevent the head of the *femu* from ſlipping out of its cavity at this place where the whole weight of the body bear upon it, and conſequently would otherwiſ be conſtantly in danger of thruſting it out ———As theſe brims are extended downward and forewards, they become leſs; and at thei internal lower part a breach is made in them from the one ſide of which to the other, ligament is placed in the recent ſubject; under which a large hole is left, which contain a fatty cellular ſubſtance and veſſels. Th reaſon of which appearance has afforde matter of debate. To me it ſeems evidently contrived for allowing a larger motion t the thigh inwards: For if the bony brim had been here continued, the neck of th thigh-bone muſt have ſtruck upon them whe the thighs were brought acroſs each other which, in a large ſtrong motion this way would have endangered the neck of the on bone, or brim of the other. Then the ve ſels which are diſtributed to the joint may ſafely enter at the ſinuoſity in the bottom of th breach; which being however larger than neceſſary for that purpoſe, allows the large mu cilaginous gland of the joint to eſcape belo the ligament, when the head of the thigh bon is in hazard of preſſing too much upon it in th

motion

otions of the thigh outwards (*a*).—— Beſides
is difference in the height of the brims, the
etabulum is otherwiſe unequal: For the lower
ternal part of it is depreſſed below the car-
aginous ſurface of the upper-part, and is not
vered with cartilage; into the upper-part of
is particular depreſſion, where it is deepeſt
d of a ſemilunar form, the ligament of the
igh-bone, commonly, though improperly,
lled the *round* one, is inſerted; while in its
ore ſuperficial lower part the large mucilagi-
us gland of this joint is lodged. The lar-
ſt ſhare of this ſeparate depreſſion is formed
the *os iſchium.*

From what has been ſaid of the condition
the three bones compoſing this *acetabulum*
new-born children, it muſt be evident, that
conſiderable part of this cavity is cartilagi-
us in them.

The *oſſa innominata* are joined at their back
rt to each ſide of the *os ſacrum* by a ſort of
ure, with a very thin interveening cartilage,
ich ſerves as ſo much glue to cement theſe
nes together; and ſtrong ligaments go from
e circumference of this unequal ſurface, to
nnect them more firmly. The *oſſa innominata*
e connected together at their fore-part by the
amentous cartilage interpoſed between the
o *oſſa pubis.*—Theſe bones can therefore have
motion in a natural ſtate, except what is
mmon to the trunk of the body, or to the
ſacrum. But it has been diſputed, whether
not they looſen ſo much from each other,
d from the *os ſacrum,* in child-birth, by the

(*a*) Petit, Memoires de l'acad. des ſciences, 1722.

flow of *mucus* to the *pelvis*, and by the throw of the labour, as that the *oſſa pubis* recede fro each other, and thereby allow the paſſage between the bones to be enlarged.——Several obſervations (*a*) ſhew that this relaxation ſometimes happens: But thoſe who had frequentl opportunities of diſſecting the bodies of wome who died immediately after being delivered o children, teach us to beware of regarding thi as the common effect of child-birth; for the found ſuch a relaxation in very few of the bodies which they examined (*b*).

Conſidering what great weight is ſupporte in our erect poſture, by the articulation of th *oſſa innominata* with the *os ſacrum*, there i great reaſon to think that if the conglutinate ſurfaces of theſe bones were once ſeparate (without which, the *oſſa pubis* cannot ſhuffle o each other), the ligaments would be violentl ſtretched, if not torn; from whence many di orders would ariſe (*c*).

Each *os innominatum* affords a ſocket (th *acetabulum*) for the thigh-bones to move i and the trunk of the body rolls here ſo much o the heads of the thigh-bones, as to allow th moſt conſpicuous motions of the *trunk*, whic are commonly thought to be performed by th bones of the ſpine.——This articulation is t
b

(*a*) Bauhin. Theat. anat. lib. 1. cap. 49.—Spigel. Ana lib 2. cap. 24.——Riolan. Anthropogr. lib. 6. cap. 12.— Diemerbroeck, Anat. lib. 9. cap. 16.

(*b*) Hildan. Epiſt cent. obſ. 46.——Dionis. Sixieme d monſt. des os.—— Morgagn. Adverſ 3. animad, 15

(*c*) Ludov. in Ephem. German. dec. 1, ann. 3. obſ. 255.

more fully deſcribed after the *oſſa femoris* examined.

The *pelvis* then has a large open above ere it is continued with the *abdomen*, is ngly fenced by bones on the ſides, back, fore-part, and appears with a wide opening ow, in the ſkeleton; but, in the recent ſub- , a conſiderable part of the opening is filled the *ſacroſciatic* ligaments, *pyriform*, *interobturator*, *levatores ani*, *gemini*, and *coccygæi* ſcles, which ſupport and protect the contain- parts better than bones could have done; ſo ſpace is only left at the loweſt part of for the large excretories, the *veſica urina-* *inteſtinum rectum*, and in females, the *ute-* to diſcharge themſelves.

The *THORAX* †, or *cheſt*, which is the part of the trunk of the body which we not yet deſcribed, reaches from below the to the belly; and, by means of the bones guard it, is formed into a large cavity: figure of which is ſomewhat conoidal; but pper ſmaller end is not finiſhed, being left for the paſſage of the wind-pipe, gullet, large blood-veſſels; and its lower part, or , has no bones, and is ſhorter before than ind; ſo that, to carry on our compariſon, pears like an oblique ſection of the conoid. des which we ought alſo to remark, that the r part of this cavity is narrower than ſome way

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Pectus, caſſum.

way above (*a*); and that the middle of i back-part is conſiderably diminiſhed by t bones ſtanding forewards into it.

The bones which form the *thorax* are th twelve dorſal *vertebræ* behind, the ribs on th ſides, and the *ſternum* before.

The *vertebræ* have already been deſcribed part of the ſpine; and therefore are now to paſſed.

The *RIBS*, or *coſtæ* *, (as if they we *cuſtodes*, or guards, to theſe principal orga of the animal-machine, the heart and lung are the long crooked bones placed at the ſi of the cheſt, in an oblique direction dow wards in reſpect of the back bone.——Th number is generally twelve on each ſide; thou frequently eleven or thirteen have been found —Sometimes the ribs are found preternatur ly conjoined or divided (*c*).

The ribs are all concave internally; wh they are alſo made ſmooth by the action of t contained parts, which, on this account, are no danger of being hurt by them; and th are convex externally, that they might re that part of the preſſure of the atmoſphe which is not balanced by the air within t lungs, during *inſpiration*.——The ends of ribs next the *vertebræ* are rounder than th are after theſe bones have advanced forewar when they become flatter and broader, and h

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(*a*) Albin. de oſſib. § 169.

* Πλευραι, περιςὲρνα, σπαθαι.

(*b*) Riolan. Comment. de oſſibus, cap. 19.--Marchetti. cap Cowper Explicat. tab. 93. and 94.— Morgagn. Adverſ.

(*c*) Sue Trad. d'oſteolog. p 141.

ıpper and lower edge, each of which is made gh by the action of the *intercoſtal* muſcles, rted into them. Theſe muſcles, being all nearly equal force, and equally ſtretched in interſtices of the ribs, prevent the broken s of theſe bones in a fracture from being oved far out of their natural place, to in-upt the motion of the vital organs.—The r edge of the ribs is more obtuſe and nder than the lower, which is depreſſed on nternal ſide by a long *foſſa*, for lodging intercoſtal veſſels and nerves; on each of which there is a ridge, to which intercoſtal muſcles are fixed. The *foſ-* not obſervable however at either end of ribs; for at the poſterior or root, the ls have not yet reached the ribs; and, at fore-end, they are ſplit away into branches, erve the parts between the ribs: Which ly teaches ſurgeons one reaſon of the ter ſafety of performing the operation of *empyema* towards the ſides of the *thorax*, either near the back or the breaſt.

t the poſterior end * of each *rib*, a little l is formed, which is divided by a middle e into two plain or hollow ſurfaces; the ſt of which is the broadeſt and deepeſt in of them. The two plains are joined to bodies of two different *vertebræ*, and the e forces itſelf into the interveening carti-—A little way from this head, we find, he external ſurface, a ſmall cavity, where ilaginous glands are lodged; and round the l, the bone appears ſpongy, where the cap-

ſular

Κώπιον, remulus.

ſular ligament of the articulation is fixed.— Immediately beyond this a flatted tubercle ri with a ſmall cavity at, and roughneſs about root, for the articulation of the rib with tranſverſe proceſs of the loweſt of the two *tebræ*, with the bodies of which the head the rib is joined.—Advancing further on external ſurface, we obſerve in moſt of ribs another ſmaller tubercle, into which gaments which connect the ribs to each ot and to the tranſverſe proceſſes of the *vert* and portions of the *longiſſimus dorſi*, are inſ ed.—— Beyond this the ribs are made flat by *ſacro-lumbalis* muſcle, which is inſerted into part of this flat ſurface fartheſt from the ſp where each rib makes a conſiderable cu called by ſome its *angle*.——Then the rib gins to turn broad, and continues ſo to its a rior end *, which is hollow and ſpongy, for reception of, and firm coalition with the tilage that runs thence to be inſerted into *ſternum*, or to be joined with ſome other tilage.——In adults, generally the cavity at end of the ribs is ſmooth and poliſhed on ſurface; by which the articulation of the tilage with it has the appearance of being ſigned for motion; but it has none.

The ſubſtance of the ribs is ſpongy, cell and only covered with a very thin external mellated ſurface, which increaſes in thick and ſtrength as it approaches the *vertebræ*.

To the fore-end of each rib a long b and ſtrong cartilage is fixed, and reaches th

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† Πλατυ, palmula.

he *ſternum*, or is joined to the cartilage of next rib. This courſe, however, is not in reight line with the rib; for generally the ilages make a conſiderable curve, the con- e part of which is upwards; therefore, at r inſertion into the *ſternum*, they make an uſe angle above, and an acute one below.— eſe cartilages are of ſuch a length as never allow the ribs to come to a right angle h the ſpine; but they keep them ſituated ſo quely, as to make an angle very conſider- y obtuſe above, till a force exceeding the icity of the cartilages is applied.——Theſe ilages, as all others, are firmer and harder rnally, than they are on their external ſur- ; and ſometimes, in old people, all their dle ſubſtance becomes bony, while a thin ilaginous *lamella* appears externally (*a*). e oſſification however begins frequently at external ſurface.——The greateſt alternate ions of the cartilages being made at their t curvature, that part remains frequently ilaginous, after all the reſt is oſſified (*b*).

he ribs then are articulated at each end, hich the one behind is doubly joined to the *ebræ*; for the head is received into the ies of two bodies of the *vertebræ*, and the r tubercle is received into the depreſſion e tranſverſe proceſs of the lower *vertebra*. —When one examines the double articu- n, he muſt immediately ſee, that no other ion can here be allowed than upwards and nwards; ſince the tranſverſe proceſs hinders the

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) Veſal. lib. 2. cap. 19.

Havers. Oſteolog. nov. diſc. 5. p. 289.

the rib to be thruſt back ; the reſiſt
on the other ſide of the *ſternum* prevent
ribs coming foreward ; and each of the
joints, with the other parts attached, op
its turning round. But then it is likewi
evident, that even the motion upwards
downwards can be but ſmall in any one r
the articulation itſelf. But as the ribs adv
forewards, the diſtance from their cente
motion increaſing, the motion muſt be lar
and it would be very conſpicuous at their
rior ends, were not they reſiſted there by
cartilages, which yield ſo little, that the
cipal motion is performed by the middle p
the ribs, which turns outwards and upw
and occaſions the twiſt remarkable in the
ribs at the place near their fore-end w
they are moſt reſiſted (*a*).

Hitherto I have laid down the ſtructur
connection which moſt of the ribs enjo
belonging to all of them ; but muſt now
ſider the ſpecialities wherein any of them
fer from the general deſcription given, or
each other.

In viewing the ribs from above downw
their figure is ſtill ſtreighter ; the uppe
being the moſt crooked of any.—Their ob
ty in reſpect of the ſpine increaſes as they
ſcend ; ſo that though their diſtances from
other is very little different at their back
yet at their fore-ends the diſtances bet
the lower ones muſt increaſe.—In conſeq
too of this increaſed obliquity of the lower

(*a*) Winſlow. Memoires de l'acad. des ſciences, 172

ch of their cartilages makes a greater curve
its progreſs from the rib towards the *ſter-*
m; and the tubercles, that are articulated
the tranſverſe proceſſes of the *vertebræ*, have
eir ſmooth ſurfaces gradually facing more up-
rds.——The ribs becoming thus more ob-
ue, while the *ſternum* advances forewards in
deſcent, makes the diſtance between the
rnum and the anterior end of the lower ribs
eater than between the *ſternum* and the ribs
ove; conſequently the cartilages of thoſe
s that are joined to the breaſt-bone are
nger in the lower than in the higher ones.—
heſe cartilages are placed nearer to each o-
r as the ribs deſcend, which occaſions the
rvature of the cartilages to be greater.

The length of the ribs increaſes from the
t and uppermoſt rib, as far down as the
enth; and from that to the twelfth, as gra-
lly diminiſhes.——The ſuperior of the two
in, or rather hollow ſurfaces, by which the
s are articulated to the bodies of the *verte-*
, gradually increaſes from the firſt to the
rth rib, and is diminiſhed after that in each
er rib.——The diſtance of their angles
n the heads always increaſes as they deſcend
he ninth, becauſe of the greater breadth of
ſacrolumbalis muſcle (*a*).

he ribs are commonly divided into *true*
falſe.

he *true* † *coſtae* are the ſeven upper ones
each ſide, whoſe cartilages are all gra-

) Winſlow. Expoſition anatomique des os ſecs, § 643.

νήσιαι, Germanæ, legitimæ.

dually longer as the ribs deſcend, and are joined to the breaſt-bone; ſo that being preſſe conſtantly between two bones, they are flatte at both ends, and are thicker, harder, and mor liable to oſſify, than the other cartilages, th are not ſubject to ſo much preſſure. Theſe rib include the heart and lungs; and therefore ar the proper or true *cuſtodes* of life.

The five inferior ribs of each ſide are th *falſe* or BASTARD *, whoſe cartilages d not reach to the *ſternum*; and therefore, wan ing the reſiſtance at their fore-part, the are there pointed; and, on this account, h ving leſs preſſure, their ſubſtance is ſofte ———The cartilages of theſe *falſe ribs* a ſhorter as the ribs deſcend.———To all the five ribs the circular edge of the *diaphrag* is connected; and its fibres, inſtead of bei ſtretched immediately tranſverſely, and running perpendicular to the ribs, are preſſ ſo as to be often, eſpecially in exſpiratio parallel to the plane in which the ribs li Nay, one may judge by the attachments whi theſe fibres have ſo frequently to the ſid of the *thorax*, a conſiderable way abo where their extremities are inſerted into t ribs, and by the ſituation of the *viſcera*, ways to be obſerved in a dead ſubject laid pine, that there is conſtantly a large concavi formed on each ſide by the *diaphragm* with theſe baſtard ribs, in which the ſtomach, liv ſpleen, &c. are contained; which, being on reckon

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† Μαλθακαι, χονδροδεις, ἀκανθαι, κλὲνες, ῥόαι, adulteri ſpuriæ, illegitimæ.

eckoned among the *viſcera naturalia*, have ocaſioned the name of *baſtard cuſtodes* to theſe ones.

Hence in ſimple fractures of the falſe ribs, ithout fever, the ſtomach ought to be kept oderately filled with food, leſt the pendulous bs falling inwards, ſhould thereby increaſe e pain, cough, &c. (a).———Hence likewiſe e may learn how to judge better of the ſeat f ſeveral diſeaſes, and to do the operation of e *empyema*, and ſome others, with more fety than we can do, if we follow the common irections.

The eight upper ribs were formerly (b) claſſd into pairs, with particular names to each vo, to wit, the *crooked*, the *ſolid*, the *pectoral*, e *twiſted*: But theſe names are of ſo little e, that they are now generally neglected.

The *firſt* rib of each ſide is ſo ſituated, at the flat ſides are above and below, while e edge is placed inwards, and the other outards, or nearly ſo; therefore ſufficient ſpace left above it for the ſubclavian veſſels and uſcle; and the broad concave ſurface is opoſed to the lungs: But then, in conſequence this ſituation, the channel for the interoſtal veſſels is not to be found, and the edges e differently formed from all the other, exept the ſecond; the lower one being round, and the other ſharp.——The head of this b is not divided into two plain ſurfaces by

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(a) Hippocrat. de articulo, § 51.——Pare, lib. 15. cap. 11.

(b) Laurent. Hiſt. anat, lib. 2. cap. 29.——Paaw, de ibus, part. 3. cap. 2.

a middle ridge, becauſe it is only articulate
with the firſt *vertebra* of the *thorax*.——I
cartilage is oſſified in adults, and is united t
the *ſternum* at right angles.——Frequentl
this firſt rib has a ridge riſing near the midd
of its poſterior edge, where one of the head
of the *ſcalenus* muſcle riſes.——Farther for
ward it is flatted, or ſometimes depreſſed by th
clavicle.

The fifth, ſixth, and ſeventh, or rathe
the ſixth, ſeventh, eighth, and ſometimes th
fifth, ſixth, ſeventh, eighth, ninth ribs, hav
their cartilages at leaſt contiguous ; and fr
quently they are joined to each other by cro
cartilages ; and moſt commonly the cartil
ges of the eighth, ninth, tenth, are connec
ed to the former and to each other by fir
ligaments.

The *eleventh*, and ſometimes the *tenth* ri
has no tubercle for its articulation with t
tranſverſe proceſs of the *vertebra*, to which
is only looſely fixed by ligaments.——T
foſſa in its lower edge is not ſo deep as in t
upper ribs, becauſe the veſſels run more t
wards the interſtice between the ribs.——I
fore-end is ſmaller than its body, and its ſho
ſmall cartilage is but looſely connected to t
cartilage of the rib above.

The *twelfth* rib is the ſhorteſt and ſtraigh
eſt.——Its head is only articulated with t
laſt *vertebra* of the *thorax* ; therefore is n
divided into two ſurfaces.——This rib is n
joined to the tranſverſe proceſs of the *vert*
bra, and therefore has no tubercle, being o

t

n pulled neceſſarily inwards by the diaphragm,
hich an articulation with the tranſverſe pro-
eſs would not have allowed. ——The *foſſa* is
t found at its under edge, becauſe the veſ-
s run below it. ——The fore-part of this
is ſmaller than its middle, and has only a
ry ſmall-pointed cartilage fixed to it.———
o its whole internal ſide the diaphragm is
nnected.

The motions and uſes of the ribs ſhall be
re particularly treated of, after the deſcrip-
n of the *ſternum*.

The heads and tubercles of the ribs of a
w-born child have cartilages on them; part
which becomes afterwards thin epiphyſes.
—The bodies of the ribs incroach gradually
r birth upon the cartilages; ſo that the
er are proportionally ſhorter, when com-
ed to the ribs, in adults, than in chil-
n.

Here I cannot help remarking the wiſe pro-
ence of our Creator, in preſerving us from
iſhing as ſoon as we come into the world.
e end of the bones of the limbs remain
a cartilaginous ſtate after birth, and are
y years before they are entirely united
he main body of their ſeveral bones; where-
he condyles of the occipital bone, and of
lower jaw, are true original proceſſes,
oſſified before birth, and the heads and
rcles of the ribs are nearly in the ſame
dition; and therefore the weight of the
e head is firmly ſupported; the actions of
ing, ſwallowing, reſpiration, &c. which
indiſpenſably neceſſary for us as ſoon as we

come into the world, are performed withou danger of ſeparating the parts of the bones tha are moſt preſſed on in theſe motions: Where as, had theſe proceſſes of the head, jaw, an ribs, been epiphyſes at birth, children mu have been expoſed to danger of dying by ſuc a ſeparation; the immediate conſequences o which would be the compreſſion of the begi ning of the *ſpinal* marrow, or want of foo or a ſtop put to reſpiration.

The *STERNUM**, or *breaſt-bone,* i the broad flat bone, or pile of bones, at th fore-part of the *thorax*.——The numb of bones which this ſhould be divided int has occaſioned debates among anatomiſt who have conſidered it in ſubjects of differe ages.——In adults of a middle age, it compoſed of three bones, which eaſily ſep rate after the cartilages connecting them a deſtroyed. Frequently the two lower bon are found intimately united; and very often old people, the *ſternum* is a continued bo ſubſtance from one end to the other; thou we ſtill obſerve two, ſometimes three tranſve lines on its ſurface; which are marks of t former diviſions.

When we conſider the *ſternum* as one bo we find it broadeſt and thickeſt above, and b coming ſmaller as it deſcends. The int nal ſurface of this bone is ſomewhat hollow for enlarging the *thorax*; but the conve ty on the external ſurface is not ſo conſpi ous, becauſe the ſides are preſſed outwa the true ribs; the round heads of whoſe tilages are received into ſeven ſmooth pits, med in each ſide of the *ſternum*, and are pt firm there by ſtrong ligaments, which on external ſurface have a particular radiated ture (*a*).—Frequently the cartilaginous fibres uſt themſelves into the bony ſubſtance of the *rnum*, and are joined by a ſort of ſuture.—— e pits at the upper part of the *ſternum* are the greateſt diſtance one from another, and, they deſcend, are nearer; ſo that the two weſt are contiguous.

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* Στῆθος, os pectoris, enſiforme, ſcutum cordis.

The ſubſtance of the breaſt-bone is cellu- , with a very thin external plate, eſpe- lly on its internal ſurface, where we may quently obſerve a cartilaginous cruſt ſpread er it (*b*). On both ſurfaces, however, a ong ligamentous membrane is cloſely bra- d; and the cells of this bone are ſo ſmall, t a conſiderable quantity of oſſeous fibres uſt be employed in the compoſition of it: hence, with the defence which the muſcles e it, and the moveable ſupport it has from cartilages, it is ſufficiently ſecured from ing broken; for it is ſtrong by its quantity bone; its parts are kept together by liga- nts; and it yields enough to elude conſider- ly the violence offered (*c*).

So far may be ſaid of this bone in general; t the three bones, of which, according to the

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(*a*) Ruyſch. Catalog. rar. fig. 9.

(*b*) Jac. Sylv. in Galen de oſſibus, cap. 12.

(*c*) Senac. in Memoires de l'acad. des ſciences. 1724.

the common account, it is compoſed in adul are each to be examined.

The *firſt*, all agree, is ſomewhat of the gure of a heart, as it is commonly painte only it does not terminate in a ſharp point. This is the uppermoſt thickeſt part of t *ſternum.*

The upper middle part of this firſt bon where it is thickeſt, is hollowed, to make pla for the *trachea arteria* ; though this cavity * principally formed by the bone being raiſed each ſide of it, partly by the clavicles thru ing it inwards, and partly by the *ſterno-maſt dei* muſcles pulling it upwards.——On the o ſide of each tubercle, there is an oblong ca ty, that, in viewing it tranſverſely from befo backwards, appears a little convex : Into the *glenæ* the ends of the clavicles are received. Immediately below theſe, the ſides of this bo begin to turn thinner ; and in each a ſuperfici cavity or a rough ſurface is to be ſeen, whe the firſt ribs are received or joined to the *ſte num.*——In the ſide of the under end of th firſt bone, the half of the pit for the ſecond r on each ſide is formed.——The upper part the ſurface behind is covered with a ſtrong l gament, which ſecures the clavicles ; and afterwards to be more particularly taken notic of.

The ſecond or middle diviſion of this bon is much longer, narrower, and thinner, tha the firſt ; but, excepting that it is a little na

rowe

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* Σφαγὴ, jugulum, furcula ſuperior.

er above than below, it is nearly equal all
r in its dimenſions of breadth or thick-
.——In the ſides of it are compleat pits
the third, fourth, fifth, and ſixth ribs,
an half of the pits for the ſecond and ſe-
th. The lines, which are marks of the for-
divifion of this bone, being extended
n the middle of the pits of one ſide to the
dle of the correſponding pits of the other
——Near its middle an unoſſified part of
bone is ſometimes found, which, freed
the ligamentous membrane or cartilage
fills it, is deſcribed as a hole; and in
place, for the moſt part, we may obſerve a
ſverſe line, which has made authors divide
bone into two.—When the cartilage be-
en this and the firſt bone is not oſſified, a
ifeſt motion of this upon the firſt may be
rved in reſpiration or in raiſing the *ſter-*
, by pulling the ribs upwards or diſtend-
the lungs with air in a recent ſubject.

he third bone is much leſs than the other
, and has only one half of the pit for the
nth rib formed in it; wherefore it might
eckoned only an *appendix* of the *ſternum.*
-In young ſubjects it is always cartilaginous,
is better known by the name of *cartilago xi-*
es or *enſiformis* *, than any other; though
ncients often called the whole *ſternum,*
rme, comparing the two firſt bones to the
handle

Clypealis, gladialis, mucronata, malum granatum, ſcu-
ſtomachi, epiglottalis, cultralis, medium furculæ inferioris,
rmis, enſiculata,

handle and this *appendix* to the blade o
ſword.—This third bone is ſeldom of the ſ
figure, magnitude, or ſituation in any two
jects; for ſometimes it is a plain triangular b
with one of the angles below, and perpendi
lar to the middle of the upper ſide, by wh
it is connected to the ſecond bone.——I
ther people the point is turned to one ſide,
obliquely forewards or backwards.—Freque
it is all nearly of an equal breadth, and in ſ
ral ſubjects it is bifurcated; whence ſome
ters give it the name of *furcella* or *furcula*
rior; or elſe it is unoſſified, in the middle.
In the greateſt number of adults it is oſſi
and tipped with a cartilage; in ſome one
of it is cartilaginous, and in others it is all
cartilaginous ſtate.—Generally ſeveral obl
ligaments fixed at one end to the cartil
of the ribs, and by the other to the outer
face of the *xiphoid* bone, connect it firml
thoſe cartilages (*a*).

So many different ways this ſmall
may be formed, without any inconvenie
But then ſome of theſe poſitions may b
directed, as to bring on a great train o
conſequences; particularly, when the lo
end is oſſified, and is too much turned
wards or inwards (*b*), or when the con

(*a*) Weitbrecht, Syndeſmolog. p. 121.

(*b*) Rolfinc. Diſſert. anat. lib. 2. cap. 41.——Pa
oſſib. part 1. cap. 3. & part 3. cap. 3.—Cedronchi de p
ſu cartilagin. mucronat.

of this *appendix* with the ſecond bone is weak (a).

he *ſternum* is joined by cartilages to the n upper ribs, unleſs when the firſt coa- s with it in an intimate union of ſubſ e; and its unequal cavity on each ſide s upper end is fitted for the ends of the cles.

he *ſternum* moſt frequently has four round l bones, ſurrounded with cartilage, in chil- born at the full time; the uppermoſt of , which is the firſt bone, being the lar- —Two or three other very ſmall bony s are likewiſe to be ſeen in ſeveral children. The number of bones increaſes for ſome , and then diminiſhes, but uncertainly, till are at laſt united into thoſe above deſcri- of an adult.

he uſes of this bone are, to afford origin inſertion to ſeveral muſcles; to ſuſtain the *aſtinum*, to defend the vital organs, the and lungs, at the fore-part; and, laſt- y ſerving as a moveable *fulcrum* of the to aſſiſt conſiderably in reſpiration: h action, ſo far it depends on the mo- of the bones, we are now at liberty to ex-

hen the ribs that are connected by their ages to the *ſternum*, or to the cartilages e true ribs, are acted upon by the inter- l muſcles, they muſt all be pulled from the oblique

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Paaw, ibid.—Bortich. act. Hafn. vol. 5. ob. 79.—Bo- pulchret. anat. tom. 2. lib. 3. § 5. Append. ad obſ. ibid. § 7. obſ. 19.

oblique poſition which their cartilages k
them in, nearer to right angles with the v
tebrae and *ſternum*, becauſe the firſt or up
moſt rib is by much the moſt fixed of a
and the cartilages making a great reſiſtanc
raiſing the anterior ends of the ribs, t
large arched middle parts turn outwards as
as upwards.——The *ſternum*, preſſed ſtro
on both ſides by the cartilages of the ribs
puſhed forewards, and that at its ſeveral pa
in proportion to the length and motion of
ſupporters, the ribs; that is, moſt at its lo
end.——The *ſternum* and the cartilages, t
raiſed forewards, muſt draw the *diaphragm* c
nected to them; conſequently ſo far ſtretc
and bring it nearer to a plane.——The po
that raiſes this bone and the cartilages, f
them ſufficiently to make them reſiſt the ac
of the *diaphragm*, whoſe fibres contract at
ſame time, and thruſt the *viſcera* of the *a*
men downwards.——The arched part of
ribs being thus moved outwards, their ante
ends and the *ſternum* being advanced forewa
and the diaphragm being brought nearer
plain ſurface, inſtead of being greatly co
on each ſide within each cavity of the *tho*
it is evident how conſiderably the cavity
which the nine or ten upper ribs are the ſ
muſt be widened, and made deeper and lo
er.——While this is doing in the upper
the lower ones, whoſe cartilages are not jo
to the *ſternum* or to other cartilages, m
very differently, though they conſpire to
ſame intention, the enlargement of the
rax: For having no fixed point to which t

ante

nterior ends are faſtened, and the *diaphragm* eing inſerted into them at the place where it uns pretty ſtreight upwards from its origin at he *vertebræ*, theſe ribs are drawn downwards y this ſtrong muſcle, and by the muſcles of he *abdomen*, which, at this time, are reſiſt-ng the ſtretching force of the bowels; while he intercoſtal muſcles are pulling them in the ontrary direction, to wit, upwards: The ef-ct therefore of either of theſe powers, which e antagoniſts to each other, is very little, as moving the ribs either up or down; but the uſcles of the *abdomen*, puſhed at this time twards by the *viſcera*, carry theſe ribs along ith them.——Thus the *thorax* is not only not lowed to be ſhortened, but is really widened is lower part, to aſſiſt in making ſufficient ace for the due diſtenſion of the lungs.

As ſoon as the action of theſe ſeveral muſ-es ceaſes, the elaſtic cartilages extending emſelves to their natural ſituation, depreſs e upper ribs, and the *ſternum* ſubſides;——e diaphragm is thruſt up by the *viſcera abdo-nalia*, and the oblique and tranſverſe muſcles the belly ſerve to draw the inferior ribs in-rds at the ſame time.——By theſe cauſes, e cavity of the breaſt is diminiſhed in all its enſions.

Though the motions above deſcribed of the s and *ſternum*, eſpecially of the latter bone, ſo ſmall in the mild reſpiration of a heal-perſon, that we can ſcarce obſerve them; they are manifeſt whenever we deſignedly eaſe our reſpiration, or are obliged to do fter exerciſe, and in ſeveral diſeaſes.

OF THE SUPERIOR EXTREMITIES

AUthors are much divided in their opinio about the number of bones which eac *ſuperior extremity* * ſhould be ſaid to conſiſt o ſome deſcribing the *clavicle* and *ſcapula* as pa of it, others claſſing theſe two bones with tho of the *thorax*: But ſince moſt quadrupeds hav no *clavicles*, and the human *thorax* can pe form its functions right when the *ſcapula* taken away (*a*), whereas it is impoſſible for to have the right uſe of our arms witho theſe bones; I muſt think that they belong the *ſuperior extremities*; and therefore ſh divide each of them into the *ſhoulder*, ar *fore-arm*, and *hand*.

The *SHOULDER* conſiſts of the *clavi* and *ſcapula*.

CLAVICULA, or *collar-bone* †, is the lo crooked bone, in figure like an *Italic ſ*, plac almoſt horizontally between the upper late part of the *ſternum*, and what is commo called the top of the ſhoulder, which, as *clavis* or beam, it bears off from the trunk the body.

The *clavicle*, as well as other long rou bones, is larger at its two ends, than in t middle. The end next to the *ſternum* ‡ triangul iangular : The angle behind is conſiderably roduced, to form a ſharp ridge, to which the anſverſe ligament extended from one clavicle the other is fixed (*a*).—The ſide oppoſite to is is ſomewhat rounded.—The middle of this rotuberant end is as irregularly hollowed, as e cavity in the *ſternum* for receiving it is rai-d; but in a recent ſubject, the irregular conca-ities of both are ſupplied by a moveable car-lage, which is not only much more cloſely con-ected every where by ligaments to the circum-rence of the articulation, than thoſe of the wer jaw are; but it grows to the two bones both its internal and external end; its ſub-ance at the internal end being ſoft, but very rong, and reſembling the intervertebral carti-ges (*b*).

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* Κωλα, γυῖα, ἐκφυάδες, Enata, adnata, explantata mem artus.

(*a*) Philoſoph. tranſact. numb. 449. § 5.

† Os jugulare, jugulum, furcula, ligula, clavis, hum quibuſdam.

‡ Παρασφαγίς.

From this internal end, the *clavicle*, for a-out two fifths of its length, is bended ob-quely forewards and downwards. On the upper d fore-part of this curvature a ſmall ridge ſeen, with a plain rough ſurface before it; hence the *muſculus ſterno-hyoideus* and *ſterno-aſtoideus* have in part their origin.——Near e lower angle a ſmall plain ſurface is often be remarked, where the firſt rib and this ne are contiguous (*c*), and are connected by firm ligament (*d*).——From this a rough plain rface is extended outwards, where the pecto-

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(*a*) Riolan. Encheirid. anat. lib. 6. cap. 13.——Winſlow, pof anat. des os frais, § 248.—Weitbrecht. Act. Petro-lit. tom. 4 p 255. et Syndeſmolog. ſect. 2. I. § 3.

(*b*) Weitbrecht, Syndeſmolog. ſect. 2: I. § 6.

(*c*) Dionis, Sixieme demonſt. des os.

(*d*) Weitbrecht, Syndeſmolog. ſect. 2 I. § 7.

ral muſcle has part of its origin.———Behind
the bone is made flat and rough by the inſer
tion of the larger ſhare of the ſubclavia
muſcle.—— After the clavicle begins to b
bended backwards, it is round, but ſoon afte
becomes broad and thin; which ſhape it retain
to its external end.———Along the extern
concavity, a rough ſinuoſity runs, from whic
ſome part of the deltoid muſcle takes it riſe
——Oppoſite to this, on the convex edge,
ſcabrous ridge gives inſertion to a ſhare of th
cucullaris muſcle. The upper ſurface of th
clavicle here is flat; but the lower is hollow
for lodging the beginning of the *muſculus ſu*
clavius; and towards its back-part a tubercl
riſes, to which, and a roughneſs near it, th
ſtrong ſhort thick ligament connecting this bon
to the *coracoid* proceſs of the *ſcapula* is fixe

The external end * of this bone is horizo
tally oblong, ſmooth, ſloping at the poſterio
ſide, and tipped in a recent ſubject with a ca
tilage, for its articulation with the *acromi*
ſcapulæ.——Round this the bone is ſpongy, fo
the firmer connection of the ligaments.

The medullary arteries, having their d
rection obliquely outwards, enter the clavicle
by one or more ſmall paſſages in the middle o
their back part.

The ſubſtance of this bone is the ſame as o
the other round long bones.

The triangular unequal interior end o
each *clavicle*, has the cartilage above de
ſcribed interpoſed betwixt it and the irreg
lar cavity of the *ſternum*.———The ligament
whic

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* 'Επωμὶς.

hich ſurround this articulation to ſecure
, are ſo ſhort and ſtrong, that little mo-
on can be allowed any way; and the ſtrong
gament that is ſtretched acroſs the upper
rcula of the *ſternum*, from the poſterior
ominent angle of the one clavicle, to the
me place of the other clavicle, ſerves to keep
ch of theſe bones more firmly in their place.
—By the aſſiſtance, however, of the move-
le intervening cartilage, the clavicle can,
this joint, be raiſed or depreſſed, and moved
ckwards and forewards ſo much, as that the
ternal end, which is at a great diſtance from
at axis, enjoys very conſpicuous motions.—
he articulation of the exterior end of the
avicle ſhall be conſidered after the deſcription
the *ſcapula*.

The clavicles of infants are not deficient in
y of their parts; nor have they any epiphy-
s at their extremities joined afterwards to
eir bodies, as moſt other ſuch long bones
ve, which preſerves them from being bended
o much, and from the danger of any unoſſified
rts being ſeparated by the force which
lls the arms forewards.

The uſes of the clavicles are, to keep the
apulæ, and conſequently all the *ſuperior ex-*
mities, from falling in and foreward upon the
rax; by which, as in moſt quadrupeds, the
otions of the arms would be much confined,
d the breaſt made too narrow.——The cla-
cles likewiſe afford origin to ſeveral muſcles,
d a defence to large veſſels.

From the ſituation, figure, and uſe of the
avicles, it is evident, that they are much ex-

poſed to fractures; that their broken parts mu generally go bye each other; and that they a difficultly kept in their place afterwards.

SCAPULA, or *ſhoulder-blade* *, is the t angular bone ſituated on the out-ſide of t ribs, with its longeſt ſide called its *ba* towards the ſpinal proceſſes of the *vertebr* and with the angle at the upper part this ſide about three inches, and the low angle at a greater diſtance from theſe proc ſes.—The back part of the *ſcapula* has nothi but the thin ends of the *ſerratus anticus ma* and *ſubſcapularis* muſcles between it and t ribs: But as this bone advances forewards, diſtance from the ribs increaſes.——The upp or ſhorteſt ſide, called the *ſuperior coſta* of t *ſcapula* is nearly horizontal, and parallel wi the ſecond rib.-- ——The lower ſide, which named the *inferior coſta*, is extended obliqu from the third to the eighth rib.——The ſitu tion of this bone, here deſcribed, is when pe ple are ſitting or ſtanding in a ſtate of ina tivity, and allowing the members to rema in the moſt natural eaſy poſture.——The in rior angle of the *ſcapula* is very acute; the u per one is near to a right angle; and what called the anterior, does not deſerve the nam for the two ſides do not meet to form an ang ——The body of this bone is concave towa the ribs, and convex behind, where it has t name of *dorſum* †.——Three proceſſes are g nera

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* Ωμοπλατος, επινωτιον, latitudo humeri, ſcoptulum ſcutulum opertum, ſpatula, ala, humerus, clypeus, ſcu thoracis.

† Χελώνιον.

ally reckoned to proceed from the *ſcapula*.
—The firſt is the large ſpine that riſes from
convex ſurface behind, and divides it une-
ally.——The ſecond proceſs ſtands out from
fore-part of the upper ſide; and, from its
ginary reſemblance to a crow's beak, is na-
d *coracoides* *.——The third proceſs is the
ole thick bulbous fore-part of the bone.
After thus naming the ſeveral conſtituent
ts of the *ſcapula*, the particular deſcription
l be more eaſily underſtood.
The *baſe*, which is tipped with cartilage in
oung ſubject, is not all ſtreight: For above
ſpine, it runs obliquely forewards to the ſu-
ior angle; that here it might not be too
tuberant backwards, and ſo bruiſe the mu-
s and teguments: Into the oblique ſpace the
ſculus patientiæ is inſerted.———At the root
the ſpine, on the back-part of the baſe, a
ngular plain ſurface is formed, by the preſ-
of the lower fibres of the *trapezius*.———
ow this the edge of the *ſcapula* is ſcabrous
rough, for the inſertion of the *ſerratus*
ior anticus and *rhomboid* muſcles.
The back-part of the inferior angle is made
ooth by the *latiſſimus dorſi* paſſing over it.
is muſcle alſo alters the direction of the *in-*
ior coſta ſome way forewards from this angle:
ſo far it is flatted behind by the origin of
teres major.——As the *inferior coſta* advan-
foreward, it is of conſiderable thickneſs, is
ntly hollowed and made ſmooth behind by
teres minor, while it has a *foſſa* formed
into

Anchoroides, ſigmoides, digitalis, anciſtroides.

into it below by part of the *ſubſcapularis*; a between the two a ridge with a ſmall depreſſi appears, where the *longus extenſor cubiti* h its origin.

The *ſuperior coſta* is very thin; and ne its fore-part there is a ſemilunar nitch, fro one end of which to the other a ligament ſtretched; and ſometimes the bone is continued, to form one, or ſometimes two holes f the paſſage of the ſcapular blood-veſſels a nerves.———Immediately behind this *ſemilun* cavity the *coraco-hyoid* muſcle has its riſe.— From the nitch to the termination of the *f* for the *teres minor*, the *ſcapula* is narrower th any where elſe, and ſupports the third proc This part has the name of *cervix*.

The whole *dorſum* of the *ſcapula* is alwa ſaid to be convex; but, by reaſon of the rai edges that ſurround it, it is divided into t cavities by the ſpine, which is ſtretched fr behind forewards, much nearer to the ſuper than to the inferior *coſta*.—The cavity abo the ſpine is really concave where the *ſupra-ſ* *natus* muſcle is lodged; while the ſurface of t bone below the ſpine, on which the *inf* *ſpinatus* muſcle is placed, is convex, excep *foſſa* that runs at the ſide of the *inferior coſt*

The internal or anterior ſurface of this bo is hollow, except in the part above the ſpi which is convex.———The *ſubſcapularis* mu is extended over this ſurface, where it for ſeveral ridges and intermediate depreſſio commonly miſtaken for prints of the rib they point out the interſtices of the bundles

fib

es of which the *ſubſcapularis* muſcle is com- d (*a*).

he ſpine * riſes ſmall at the baſe of the *ula*, and becomes higher and broader as it nces forewards.——On the ſides it is une- lly hollowed and crooked, by the actions of adjacent muſcles.——Its ridge † is divi- into two rough flat ſurfaces: Into the up- one, the *trapezius* muſcle is inſerted; and lower one has part of the *deltoid* fixed to ——The end of the ſpine, called *acromi-* , or top of the ſhoulder, is broad and flat, is ſometimes only joined to the ſpine by a lage (*b*).——The anterior edge of the *nion* is flat, ſmooth, and covered with a lage, for its articulation with the exter- nd of the clavicle; and it is hollowed w, to allow a paſſage to the *infra* and *ſu- ſpinati* muſcles, and free motion to the *os ri*.

he *coracoid* § proceſs is crooked, with its inclining forewards; ſo that a hollow is at the lower ſide of its root, for the ge of the *infra-ſcapularis* muſcle.——end of this proceſs is marked with three ſurfaces. Into the internal, the *ſerra- ninor anticus* is inſerted: From the exter- one head of the *biceps flexor cubiti* riſes; from the lower one, the *coracobrachialis* has,

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Winſlow, in Memoires de l' acad. des ſciences, 1722.

αχις, ὑπερόχη ὠμοπλατῶν, eminentia ſcapularum.

terigium, criſta.

κρώμις ἀγκυροειδὴς, κορακοειδὴς, κατακλεῖς, acromii os, us armus, roſtrum porcinum, proceſſus digitalis,

Sue Trad. d' oſteol. p. 160.

γκυροειδὴς, σίγμοειδης, roſtriformis.

has its origin. —— At the upper-part of t root of this proceſs, immediately before t *ſemilunar* cavity, a ſmooth tubercle appea where a ligament from the *clavicle* is fix From all the external ſide of this corac *apophyſe*, a broad ligament goes out, whi becomes narrower where it is fixed to t *acromion*. —— The ſharp pain, violent infla mation, and tedious cure of contuſions in t part, are probably owing to theſe tendons ligaments being hurt.

From the *cervix ſcapulæ* the third proc is produced. The fore-part of this is for ed into a *glenoid* cavity *, which is of ſhape of the longitudinal ſection of an being broad below, and narrow above.— Between the brims of this hollow and fore-part of the root of the ſpine, a l ſinuoſity is left for the tranſmiſſion of *ſupra* and *infra ſpinati* muſcles; and on upper-part of theſe brims we may remar ſmooth ſurface, where the ſecond head of *biceps flexor cubiti* has its origin. —— root of the *ſupercilia* is rough all round, the firmer adheſion of the capſular ligam of the articulation, and of the cartilage wh is placed on theſe brims, where it is th but becomes very thin as it is continued wards the middle of the cavity, which it l all over.

The medullary veſſels enter the *ſcapula* the baſe of the ſpine.

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* Ὠμοκότυλης.

The ſubſtance of the *ſcapula*, as in all o-
r broad flat bones, is cellular, but of an un-
al thickneſs; for the neck and third pro-
s are thick and ſtrong. The inferior *coſta*,
ne, and coracoid proceſs, are of a middle
ckneſs; and the body is ſo preſſed by the
ſcles, as to become thin and diaphanous.

The *ſcapula* and clavicle are joined by plain
faces, tipped with cartilage *; by which
ther bone is allowed any conſiderable mo-
n, being tightly tied down by the common
ſular ligament, and by a very ſtrong one
ich proceeds from the coracoid proceſs;
divides into two before it is fixed into
clavicle, with ſuch a direction, as either
allow this bone to have a ſmall rota-
, in which its poſterior edge turns more
kwards, while the anterior one riſes far-
forewards; or it can yield to the fore-
of the *ſcapula* moving downwards, while
back-part of it is drawn upwards; in both
ch caſes, the oblong ſmooth articulated
aces of the *clavicle* and *ſcapula* are not in
ſame plane, but ſtand a little tranſverſely,
croſs each other, and thereby preſerve
joint from luxations, to which it would
bject, if either of the bones was to move
he other perpendicularly up and down,
out any rotation. — Sometimes a move-
ligamentous cartilage is found in this
; otherwhiles ſuch a cartilage is only
poſed at the anterior half of it; and in
old ſubjects I have found a ſeſamoid
bone

Acromion, κατακλεις, clauſuræ.

bone here (*a*). —The *ſcapula* is conne to the head, *os hyoides*, *vertebræ*, ribs, arm-bone, by muſcles, that have one end f ened to theſe bones, and the other to the *ſ* *pula*, which can move it upwards, downwa backwards, or forewards; by the quick ſucceſ of theſe motions, its whole body is carried circle. But being alſo often moved as u an axis perpendicular to its plane, its circ ference turns in a circle whoſe center axis is (*b*). Whichever of theſe motion performs, it always carries the outer en the clavicle and the arm along with it.— The *glenoid* cavity of this bone receives *os humeri*, which plays in it as a ball in a ket, as will be explained more hereafter.

The uſe of the *ſcapula* is, to ſerve as a *crum* to the arm; and, by altering its tion on different occaſions, to allow alw the head of the *os humeri* a right ſitu ſocket to move in; and thereby to aſſiſt to enlarge greatly the motions of the *ſupe* *extremity*, and to afford the muſcles w riſe from it more advantageous actions, altering their directions to the bone w they are to move. —— This bone alſo ſe to defend the back-part of the *thorax*, an often employed to ſuſtain weights, or to forces, too great for the arm to bear.

The baſe, *acromion*, coracoid proceſs, head of the *ſcapula*, are all in a cartilagi ſtate at birth; and the three firſt are jo as *epiphyſes*; while the head, with the *gl*

ca

(*a*) Jac. Sylv. Iſagog. anat. lib. 1. cap. 2.

(*b*) See Winſlow, Memoires de l'acad. des ſciences, vity, is not formed into a diſtinct ſeparate ne, but is gradually produced by the oſſifi- tion of the body of this bone being continued rewards.

The *ARM* has only one bone, beſt known the *Latin* name of *os humeri* *; which is g, round and nearly ſtreight.

The upper end of this bone † is formed in- a large round ſmooth head, whoſe middle int is not in a ſtreight line with the axis of bone, but ſtands obliquely backwards from ——The extent of the head is diſtinguiſhed a circular *foſſa* ſurrounding its baſe, where head is united to the bone, and the capſu- ligament of the joint is fixed.———Below fore-part of its baſe two tubercles ſtand t: The ſmalleſt one, which is ſituated moſt the inſide, has the tendon of the *ſubſcapularis* ſcle inſerted into it.——The larger more ernal protuberance is divided, at its upper t, into three ſmooth plain ſurfaces; into anterior of which, the *muſculus ſupra ſpina-*; into the middle or largeſt, the *infra-ſpina-*; into the one behind, the *teres minor*, is ſerted.———Between theſe two tubercles, ex- ly in the fore-part of the bone, a deep long *a* is formed, for lodging the tendinous head the *biceps flexor cubiti*; which, after paſſing, a manner peculiar to itſelf, through the ity of the articulation, is tied down by a dinous ſheath extended acroſs the *foſſa*; in ich, and in the neighbouring tubercles, are

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Ἀκρολία, ωλένη os brachii, armi, adjutorium, parvum chium, canna brachii.

Acrocolium.

ſeveral remarkable holes, which are pen
trated by the tendinous and ligamentous fibre
and by veſſels.——On each ſide of this *foſſ*
as it deſcends in the *os humeri*, a rough ridg
gently flatted in the middle, runs from t
roots of the tubercles.———The tendon
the *pectoral* muſcle is fixed into the anteri
of theſe ridges, and the *latiſſimus dorſi*, a
teres major, are inſerted into the internal o
——A little behind the lower end of this la
another rough ridge may be obſerved, whe
the *coraco-brachialis* is inſerted.——From t
back part of the root of the largeſt tuberc
a ridge alſo is continued, from which the *b*
vis extenſor cubiti riſes.——This bone is flatt
on the inſide, about its middle, by the be
of the *biceps flexor cubiti*.——In the mid
of this plain ſurface, the entry of the medul
ry artery is ſeen ſlanting obliquely downwar
——At the fore ſide of this plane the bo
riſes in a ſort of ridge, which is rough, a
often has a great many ſmall holes in it, whe
the tendon of the ſtrong *deltoid* muſcle is
ſerted; on each ſide of which the bone
ſmooth and flat, where the *brachiæus inter*
riſes. The exterior of theſe two flat ſurfa
is the largeſt; behind it a ſuperficial ſpi
channel, formed by the *muſcular* nerve a
the veſſels that accompany it, runs from
hind forewards and downwards.—— The bo
of the *os humeri* is flatted behind by the
tenſors of the fore-arm———Near the low
end of this bone, a large ſharp ridge is
tended on its outſide, from which the *m*
ſculus ſpinator radii longus, and the long

he

ead of the *extenſor carpi radialis* riſe.——ppoſite to this, there is another ſmall ridge which the *aponeurotic* tendon, that gives rigin to the fibres of the internal and external *achiœi* muſcles is fixed; and from a little epreſſion on the fore-ſide of it, the *pronator adii teres* riſes.

The body of the *os humeri* becomes graually broader towards the lower end, where has ſeveral proceſſes; at the roots of which, ere is a cavity before, and another behind *. he anterior is divided by a ridge into two; e external, which is the leaſt, receives the d of the *radius*; and the internal receives e *coronoid* proceſs of the *ulna* in the flections f the fore-arm, while the poſterior deep iangular cavity lodges the *olecranon* in the xtenſions of that member.———The bone bewixt theſe two cavities is preſſed ſo thin by e proceſſes of the *ulna*, as to appear diaphaous in ſeveral ſubjects.———The ſides of the oſterior cavity are ſtretched out into two proeſſes, one on each ſide: Theſe are called *ndyles*; from each of which a ſtrong ligaent goes out to the bones of the *fore arm*.———The external *condyle*, which has an obque direction alſo forewards in reſpect of the ternal, when the arm is in the moſt natural oſture (*a*), is equally broad, and has an obuſe ſmooth head riſing from it forewards.——rom the rough part of the *condyle*, the inerior head of the *bicornis*, the *extenſor diitorum communis, extenſor carpi ulnaris, an-*

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* βαθμίδες.

(*a*) Winſlow, Memoires de l'acad. des ſciences, 1722.

conœus, and ſome part of the *ſupinator ra*
brevis, take their riſe; and on the ſmoo
head the upper end of the *radius* plays.—
Immediately on the outſide of this, there
a ſinuoſity made by the ſhorter head of t
bicornis muſcle, upon which the *muſcul*
nerve is placed.——The internal *condyle*
more pointed and protuberant than the exte
nal, to give origin to ſome part of the *fle*
carpi radialis, *pronator radii teres*, *palmar*
longus, *flexor digitorum ſublimis*, and *flexor ca*
pi ulnaris.--Between the two *condyles*, is the *troc*
lea or pully, which conſiſts of two lateral pr
tuberances, and a middle cavity, that are ſmoo
and covered with cartilage—When the for
arm is extended, the tendon of the internal *br*
chiœus muſcle is lodged in the fore part of t
cavity of this pully.—The external protub
rance, which is leſs than the other, has a ſha
edge behind; but forewards, this ridge is o
tuſe, and only ſeparated from the little head, a
ready deſcribed, by a ſmall *foſſa*, in which t
joined edges of the *ulna* and *radius* move.—
The internal protuberance of the pully is larg
and higheſt; and therefore in the motions
the *ulna* upon it, that bone would be inclin
outwards, was it not ſupported by the *radius*
that ſide.—Between this internal protuberan
and *condyle*, a ſinuoſity may be remarked, whe
the *ulnar* nerve paſſes.

The ſubſtance and the internal ſtructure
the *os humeri* is the ſame, and diſpoſed in t
ſame way, as in other long bones.

The round head at the upper end of th
bone is articulated with the *glenoid* cavity

th

ie *ſcapula*; which being ſuperficial, and ha-
ing long ligaments, allows the arm a free
nd extenſive motion. —— Theſe ligaments
e however conſiderably ſtrong. For, beſides
e common capſular one, the tendons of the
uſcles perform the office, and have been de-
ribed under the name of *ligaments*.——Then
e *acromion* and *coracoid* proceſs, with the
ong broad ligaments ſtretched betwixt them,
cure the articulation above, where the great-
t and moſt frequent force is applied to thruſt
e head of the bone out of its place. It is
ue that there is not near ſo ſtrong a defence
the lower part of the articulation; but in
e ordinary poſtures of the arm, that is, ſo
ng as it is at an acute angle with the
unk of the body, there cannot be any
rce applied at this place to occaſion a luxa-
on, ſince the joint is protected ſo well a-
ve.

The motions which the arm enjoys by this
iculation, are to every ſide; and by the
cceſſion of theſe different motions, a circle
ay be deſcribed. Beſides which, the bone
rforms a ſmall rotation round its own *axis*.
t though this can be performed with the
und head in all poſitions; yet as theſe vary,
e effects upon the body of the bone are
y different: For, if the middle of the head
the center of rotation, as it is when the
n hangs down by the ſide, the body of the
ne is only moved forewards and backwards;
cauſe the *axis* of motion of the head is near-

ly

ly at right angles with the length of the bon (*a*) ; whereas, when the arm is raiſed to righ angles with the trunk of the body, the cen ter of motion, and the axis of the bone, com to be in the ſame ſtreight line ; and ther fore the body of the *os humeri* performs th ſame motion with its head.——–——Thoug the motions of the arm ſeem to be very exte ſive, yet the larger ſhare of them depends the motion of the *ſcapula*.—The lower end the *os humeri* is articulated with the bones the fore-arm, and carries them with it in its motions, but ſerves as a baſe on which th perform the motions peculiar to themſelves; ſhall be deſcribed afterwards.

Both the ends of this bone are cartilagino in a new-born infant, and the large head w the two tubercles, and the *trochlea* with t two *condyles*, become *epiphyſes* before they united to the body of the bone.

The *FORE-ARM* † conſiſts of two lo bones, the *ulna* and *radius* ; whoſe ſituati in reſpect of each other, is oblique in the le ſtraining or moſt natural poſture ; that is, *ulna* is not directly behind, nor on the out of the *radius*, but in a middle ſituation betw theſe two, and the *radius* croſſes it.—The tuation however of theſe two bones, and of the other bones of the *ſuperior extremity* t are not yet deſcribed, is frequently altered; therefore, to ſhun repetitions, I deſire it may now remarked, that, in the remaining acco of the *ſuperior extremity*, I underſtand by t

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(*a*) Hippocrat. de articul. § 1.

† Cubitus, πῆχυς, ὠλένη, πυγὼν, ulna, lacertus.

m of *poſterior*, that part which is in the e direction with the back of the hand; *anterior*, that anſwering to the palm; by *in- nal*, that on the ſame ſide with the thumb; *external*, the ſide neareſt to the little fin- ; ſuppoſing the hand always to be in a ddle poſition between *pronation* and *ſupi- ion.*

ULNA †, ſo named from its being uſed as a aſure, is the longeſt of the two bones of the e-arm, and ſituated on the outſide of the *lius.*

At the upper end of the *ulna* are two proceſ- —The poſterior is the largeſt, and formed a hook, whoſe concave ſurface moves up- the pully of the *os humeri*, and is called *ranon* ‡, or top of the cubit.—The convex k part of it is rough and ſcabrous, where the *gus, brevis*, and *brachiœus externus*, are in- ted. The *olecranon* makes it unneceſſary t the tendons of the extenſor muſcles ſhould s over the end of the *os humeri*; which uld have been of ill conſequence in the great tions of this joint, or when any conſiderable ernal force is applied to this part (*a*).—The erior proceſs is not ſo large, nor does it reach igh as the one behind; but is ſharper at its , and therefore is named *coronoid.*—Between ſe two proceſſes, a large ſemicircular or *ſig- id* concavity is left; the ſurface of which, on

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Cubitus, πῆχυς, προπήχυον, focile majus, canna vel arundo or, et inferior brachii.

Ἀγκὼν, gibber cubitus, additamentum necatum.

a) Winſlow, Expoſition anatomique du corps humain, ité des os ſecs, § 979.

on each ſide of a middle riſing, is ſlanting, a
exactly adapted to the pully of the bone of t
arm.———Acroſs the middle of it, there is
ſmall ſinuoſity for lodging mucilaginous gland
where, as well as in a ſmall hollow on the
ternal ſide of it, the cartilage that lines t
reſt of its ſurface is wanting.———Round t
brims of this concavity the bone is roug
where the capſular ligament of the joint is i
planted.——Immediately below the *olecran*
on the back-part of the *ulna*, a flat triangu
ſpongy ſurface appears, on which we commo
ly lean.—At the internal ſide of this, there
a larger hollow ſurface, where the *muſculus*
conœus is lodged; and the ridge at the inſ
of this gives riſe to the *muſculus ſupinator ra*
brevis.———Between the top of the ridge a
the *coronoid* proceſs is the ſemilunated ſmoo
cavity, lined with cartilage, in which, and
ligament extended from the one to the ot
end of this cavity, the round head of the *ra*
us plays.—Immediately below it a rough holl
gives lodging to mucilaginous glands.—Bel
the root of the *coronoid* proceſs, this bone is
brous and unequal, where the *brachiœus inter*
is inſerted.—On the outſide of that we obſe
a ſmooth concavity, where the beginning of
flexor digitorum profundus ſprouts out.

The body of the *ulna* is triangular.—T
internal angle is very ſharp where the li
ment that connects the two bones is fixed
The ſides, which make this angle, are flat
rough, by the action and adheſion of the ma
muſcles which are ſituated here.———At

ance of one third of the length of the *ul-* from the top, in its fore-part, the paſſage of medullary veſſels is to be remarked ſlanting wards. ——The external ſide of this bone is ooth, ſomewhat convex, and the angles at h edge of it are blunted by the preſſure of muſcles equally diſpoſed about them.

As this bone deſcends, it becomes gradually ller; ſo that its lower end terminates in a le head, ſtanding on a ſmall neck.———Towrds the fore but outer part of which laſt, an ique ridge runs, that gives riſe to the *pro-r radii quadratus.*———The head is round, ooth, and covered with a cartilage on its inal ſide, to be received into the ſemilunar ity of the *radius;* while a *ſtyloid* proceſs † s from its outſide, to which is fixed a ſtrong ment that is extended to the *os cuneiforme piſiforme* of the wriſt.—Between the back- of that internal ſmooth ſide and this pro-, a ſinuoſity is left for the tendon of the *nſor carpi ulnaris.*———On the fore-part of root of the proceſs, ſuch another depreſ- may be remarked for the paſſage of the r artery and nerve.—The end of the bone is oth, and covered with a cartilage.—Between nd the bones of the wriſt, a doubly-con- moveable cartilage is interpoſed; which is ntinuation of the cartilage that covers the r end of the *radius,* and is connected looſe- the root of the *ſtyloid* proceſs, and to the h cavity there; in which mucilaginous ds are lodged.

The

περονῆ, malleolus externus.

The *ulna* is articulated above with the lo end of the *os humeri*, where theſe bones h depreſſions and protuberances correſpondin each other, ſo as to allow an eaſy and ſec extenſion of the fore-arm to almoſt a ſtrei line with the arm, and flection to a very a angle; but, by the ſlanting poſition of pully, the lower part of the fore-arm is tu outwards in the extenſion, and inwards in flection (*a*); and a very ſmall kind of rota is likewiſe allowed in all poſitions, eſpeci when the ligaments are moſt relaxed by fore-arm being in a middle degree of flec ——The *ulna* is alſo articulated with the *ra* and *carpus*, in a manner to be related afterw

RADIUS *, ſo called from its imagine ſemblance to a ſpoke of a wheel, or to a ver's beam, is the bone placed at the inſid the fore-arm. Its upper end is formed in circular little head, which is hollowed fo articulation with the tubercle at the ſid the pully of the *os humeri*; and the ha the round circumference of the head ne the *ulna* is ſmooth, and covered with a c lage, in order to be received into the ſemil ted cavity of that bone.———below the h the *radius* is much ſmaller; therefore this is named its *cervix*, which is made roun the action of the *ſupinator radii brevis*.— the external root of this neck, a tuberous ceſs riſes; into the outer part of which th *ceps flexor cubiti* is inſerted.———From th ridge runs downwards and inwards, wher

ſupi

(*a*) Winſlow, Memoires de l'acad. des ſciences, 172

* Κερχις, παραπήχιον, focile minus, canna minor, minor.

inator radii brevis is inſerted ; and a little ow, and behind this ridge, there is a rough brous ſurface, where the *pronator radii te-* is fixed.

The body of the *radius* is not ſtreight, but vex on its internal and poſterior ſurfaces ; ere it is alſo made round by the equal preſ- e of the circumjacent muſcles, particularly the *extenſors* of the thumb; but the ſur- es next to the *ulna* are flatted and rough, for origin of the muſcles of the hand; and h terminate in a common ſharp ſpine, to ich the ſtrong ligament extended betwixt two bones of the fore-arm is fixed.—A little ow the beginning of the plain ſurface, on its e-part, where the *flexor* muſcle of the laſt t of the thumb takes its origin, the paſſage he medullary veſſels is ſeen ſlanting upwards. —The *radius* becomes broader and flatter to- ds the lower end, eſpecially on its fore-part, re its *pronator quadratus* muſcle is ſituated.

The lower end of the *radius* is larger than ſuperior ; though not in ſuch a diſpropor- as the upper end of the *ulna* is larger than ower end.——Its back-part has a flat ſtrong e in the middle, and *foſſæ* on each ſide.—— ſmall groove, immediately on the outſide he ridge, the tendon of the *extenſor ter- ternodii policis* plays.——In a large one be- d this, the tendons of the *indicator* and of common *extenſor* muſcles of the fingers .——Contiguous to the *ulna*, there is a ſmall eſſion made by the *extenſor minimi digiti*. —On the inſide of the ridge there is a broad depreſſion, which ſeems again ſubdivided, wh the two tendons of the *bicornis*, or *exte* *carpi radialis*, are lodged.——The internal of this end of the *radius* is alſo hollowed the extenſors of the firſt and ſecond joint the thumb; immediately above which, a li rough ſurface ſhews where the *ſupinator r* *longus* is inſerted.——The ridges at the ſ of the grooves, in which the tendons p have an annular ligament fixed to them, which the ſeveral ſheaths for the tendons formed.———The fore-part of this end of *radius* is alſo depreſſed, where the flexor the fingers and *flexor carpi radialis* paſs.— The external ſide is formed into a ſemilun ſmooth cavity, lined with a cartilage, for ceiving the lower end of the *ulna*.—— loweſt part of the *radius* is formed into an long cavity; in the middle of which is a ſ tranſverſe riſing, gently hollowed, for lod mucilaginous glands; while the riſing itſel inſinuated into the conjunction of the bones of the wriſt that are received into th vity.———The internal ſide of this articula is fenced by a remarkable proceſs * of *radius*, from which a ligament goes out to wriſt, as the *ſtyloid* proceſs of the *ulna* wit ligament guards it on the outſide.

The ends of both the bones of the arm being thicker than the middle, there conſiderable diſtance between the bodie theſe bones; in the larger part of whi ſtrong tendinous, but thin ligament, is ext ed, to give a large enough ſurface for the o f the numerous fibres of the muſcles ſituated ere, that are ſo much ſunk between the bones, to be protected from injuries, which they ould otherwiſe be expoſed to. But this liga-ent is wanting near the upper end of the fore-m, where the *ſupinator radii brevis*, and *fle-r digitorum profundus*, are immediately connect-d (*a*).

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* Mallcolus internus, proceſſus ſtyloides.

Both ends of the bones of the fore-arm e firſt cartilages, and then *epiphyſes* in chil-en.

As the head of the *radius* receives the tubercle f the *os humeri*, it is not only bended and ex-nded along with the *ulna*, but may be moved und its *axis* in any poſition; and that this otion round its *axis* may be ſufficiently large, e ligament of the articulation is extended rther down than ordinary on the neck of this ne, before it is connected to it; and it is ve- thin at its upper and lower part, but makes firm ring in the middle.——This bone is al-joined to the *ulna* by a double articulation; r above, a tubercle of the *radius* plays in a cket of the *ulna*; whilſt below, the *radius* ves the ſocket, and the *ulna* the tubercle: t then the motion performed in theſe two is ry different; for at the upper end, the *ra-us* does no more than turn round its axis; while the lower end, it moves in a ſort of *cycloid* on the round part of the *ulna*; and as the nd is articulated and firmly connected here th the *radius*, they muſt move together.——

(*a*) Weitbrecht, Syndeſmolog. fig. 10. 11.

When the palm is turned uppermoſt, the *r* *dius* is ſaid to perform the *ſupination*; when th back of the hand is above, it is ſaid to be *pron* But then the quickneſs and large extent of the two motions are aſſiſted by the *ulna*, which, was before obſerved, can move with a kind ſmall rotation on the ſloping ſides of the pu ley. This lateral motion, tho' very inconſide able in the joint itſelf, is conſpicuous at the lo er end of ſuch a long bone; and the ſtrong lig ment connecting this lower end to the *carpu* makes the hand more readily to obey theſe m tions——When we deſign a large circular tu of our hand, we increaſe it by the rotation the *os humeri*, and ſometimes employ the ſpi and *inferior extremities* to make theſe motio of pronation or ſupination of the hand lar enough.

The *HAND* * comprehends all from the joi of the wriſt to the points of the fingers. I back-part is convex, for greater firmneſs a ſtrength; and it is concave before, for contai ing more ſurely and conveniently ſuch bodi as we take hold of.——One half of the ha has an obſcure motion in compariſon of wh the other has, and ſerves as a baſe to the mov able half; which can be extended back v ry little farther than to a ſtreight line with t fore-arm, but can be conſiderably bended fo wards.

As the bones that compoſe the hand are different ſhapes and uſes, while ſeveral of the that are contiguous agree in ſome general ch racters; the hand is, on this account, commo y divided into the *carpus*, *metacarpus*, and *finers*; among which laſt the thumb is reckond.

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* Ἀκρόχειρ, ſumma manus.

The *CARPUS* * is compoſed of eight ſmall pongy bones, ſituated at the upper part of the and. I ſhall deſcribe each of theſe bones, uner a proper name taken from their figure *a*); becauſe the method of ranging them by umbers leaves anatomiſts too much at liberty o debate very idly, which ought to be prefered to the firſt number; or, which is worſe, ſeeral, without explaining the order they obſerve, ifferently apply the ſame numbers, and ſo onfound their readers.——— But that the deription of theſe bones may be in the ſame orer as they are found in the generality of anaomical books, I ſhall begin with the range of ones that are concerned in the moveable oint of the wriſt, or are connected to the ore arm, and ſhall afterwards conſider the four hat ſupport the thumb and *oſſa metacarpi* of he fingers.

The eight bones of the *carpus* are, *os ſcaphoies*, *lunare*, *cuneiforme*, *piſiforme*, *trapezium*, *rapezoides*, *magnum*, *unciforme*.

The *ſcaphoides* is ſituated moſt internally of hoſe that are articulated with the fore-arm.—he *lunare* is immediately on the outſide of he former.———The *cuneiforme* is placed ſtill ore externally, but does not reach ſo high up s the other two. ——The *piſiforme* ſtands forewards into the palm from the *cuneiforme*.—The *rapezium* is the firſt of the ſecond row, and s ſituated betwixt the *ſcaphoides* and firſt joint

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* Κτυς, brachiale, prima palmæ pars, raſetta.

(*a*) Lyſer. Cult. anat. lib. 5. cap. 2.

of the thumb.——The *trapezoides* is immediately on the outſide of the *trapezium*.—— The *os magnum* is ſtill more external.——Th *unciforme* is farther to the ſide of the littl finger.

Os ſcaphoides * is the largeſt of the eight except one. It is convex above, concave and oblong below; from which ſmall reſemblance o a boat it has got its name.——Its ſmooth convex ſurface is divided by a rough middle *foſſ* which runs obliquely croſs it.———The uppe largeſt diviſion is articulated with the *radius*.— Into the *foſſa* the common ligament of th joint of the wriſt is fixed; and the lower d viſion is joined to the *trapezium* and *trapezo des*.———The concavity receives more than a half of the round head of the *os magnum*.— The external ſide of this hollow is formed into a ſemilunar plane, to be articulated with th following bone.———The internal, poſterior and anterior edges are rough, for fixing th ligaments that connect it to the ſurroundin bones.

Os lunare † has a ſmooth convex upper ſurface, by which it is articulated with the *radius*.——The internal ſide, which gives th name to the bone, is in the form of a creſcent, and is joined with the *ſcaphoid*;——th lower ſurface is hollow, for receiving part o the head of the *os magnum*.——On the ou ſide of this cavity is another ſmooth, but narro oblong ſinuoſity, for receiving the upper en of the *os unciforme*:——On the outſide o

whic

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[*] Κοτυλοειδὲς, naviculare.

[†] Lunatum.

hich a ſmall round convexity is found, for its
nnection with the *os cuneiforme.*——Between
e great convexity above, and the firſt deep
ferior cavity, there is a rough *foſſa*, in which
e circular ligament of the joint of the wriſt
fixed.

Os cuneiforme * is broader above, and towards
e back of the hand, than it is below and fore-
rds: which gives it the reſemblance of a
edge.———The ſuperior ſlightly convex ſur-
e is included in the joint of the wriſt, be-
g oppoſed to the lower end of the *ulna.*——
low this the cuneiform bone has a rough
ſa, wherein the ligament of the articula-
n of the wriſt is fixed.——On the internal
e of this bone, where it is contiguous to the
lunare, it is ſmooth and ſlightly concave.—
lower ſurface, where it is contiguous to the
unciforme is oblong, ſomewhat ſpiral, and
ncave.— ——Near the middle of its anterior
face a circular plane appears, where the *os*
ſiforme is ſuſtained.

Os piſiforme † is almoſt ſpherical, except one
cular plane, or ſlightly hollow ſurface, which
overed with cartilage for its motion on the
eiforme bone, from which its whole rough
y is prominent forewards into the palm;
ing the tendon of the *flexor carpi ulnaris*,
a ligament from the *ſtyloid* proceſs of the
, fixed to its upper part; the *tranſverſe*
ment of the wriſt is connected to its in-
al ſide; ligaments extended to the *unci-*
n bone, and to the *os metacarpi* of the

little

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* Triquetrum.

† Cartilaginoſum, ſubrotundum, rectum.

little finger, are attached to its lower pa the *abductor minimi digiti* has its origin fr its fore-part ; and, at the internal ſide of it, ſmall depreſſion is formed, for the paſſage the ulnar nerve.

*Trapezium** has four unequal ſides and gles in its back-part, from which it has got name———Above, its ſurface is ſmooth, ſli ly hollowed, and ſemicircular, for its c junction with the *os ſcaphoides.*——Its exte ſide is an oblong concave ſquare, for re ving the following bone.———The inferior face is formed into a pulley ; the two pr berant ſides of which are external and in nal. On this pulley the firſt bone of the thu is moved.———At the external ſide of the ternal protuberance, a ſmall oblong ſm ſurface is formed by the *os metacarpi ind* ———The fore-part of the *trapezium* is minent in the palm, and, near to the ex nal ſide, has a ſinuoſity in it, where tendon of the *flexor carpi radiulis* is lod on the ligamentous ſheath of which the don of the *flexor tertii internodii pollicis* pl And ſtill more externally the bone is ſcabr where the *tranſverſe* ligament of the wri connected, the *abductor* and *flexor primi i nodii pollicis* have their origin, and ligam go out to the firſt bone of the thumb.

Os trapezoides †, ſo called from the gular quadrangular figure of its back- is the ſmalleſt bone of the wriſt, excep *piſiforme.*———The figure of it is an irre ube.———It has a ſmall hollow ſurface above, y which it joins the *ſcaphoides;* a long convex ne internally, where it is contiguous to the *rapezium;* a ſmall external one, for its conunction with the *os magnum;* and an inferior onvex ſurface, the edges of which are howver ſo raiſed before and behind, that a ſort of ulley is formed, where it ſuſtains the *os metaarpi indicis.*

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* Os cubiforme, trapezoides, multangulum majus.

† Trapezium, multangulum minus.

Os magnum *, ſo called becauſe it is the rgeſt bone of the *carpus,* is oblong, having our quadrangular ſides, with a round upper nd, and a triangular plain one below.——— he round head is divided by a ſmall riſing, ppoſite to the connection of the *os ſcaphoides* nd *lunare,* which together form the cavity r receiving it.——On the inſide a ſhort plain rface joins the *os magnum* to the *trapezoides.* —On the outſide is a long narrow concave rface, where it is contiguous to the *os uncirme.*———The lower end, which ſuſtains the etacarpal bone of the middle finger, is tringular, ſlightly hollowed, and farther advaned on the internal ſide than on the external, aving a conſiderable oblong depreſſion made n the advanced inſide by the metacarpal bone f the fore-finger; and generally there is a mall mark of the *os metacarpi digiti annularis* n its external ſide.

Os unciforme † has got its name from a hin broad proceſs that ſtands out from it foreards into the palm, and is hollow on its inde, for affording paſſage to the tendons of the

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[*] Maximum, capitatum.

[†] Cuneiforme.

the flexors of the fingers. To this proc alſo the tranſverſe ligament is fixed, th binds down and defends theſe tendons; a the *flexor* and *abductor* muſcles of the lit finger have part of their origin from it.— The upper plain ſurface is ſmall, convex, a joined with the *os lunare* :———The intern ſide is long, and ſlightly convex, adapted the contiguous *os magnum* :——The extern ſurface is oblique, and irregularly convex, be articulated with the cuneiform bone :— The lower end is divided into two conca ſurfaces; the external is joined with the m tacarpal bone of the little finger, and the i ternal one is fitted to the metacarpal bone the ring-finger.

In the deſcription of the preceeding eig bones, I have only mentioned thoſe plain ſu faces covered with cartilage, by which they articulated to each other, or to ſome ther bones, except in ſome few caſes, wh ſomething extraordinary was to be obſerve and I have deſignedly omitted the other rou ſurfaces, leſt, by crowding too many wo in the deſcription of ſuch ſmall bones, t whole ſhould be unintelligible: But theſe ſ brous parts of the bones may eaſily be und ſtood, after mentioning their figure, if it obſerved, that they are generally found o towards the back or palm of the hand; t they are all plain, larger behind than befo and that they receive the different ligamen by which they are either connected to neig bouring bones, or to one another; for th ligaments cover all the bones, and are ſo tely applied to them, that, at firſt view, whole *carpus* of a recent ſubject appears ſmooth bone (*a*).

s the ſurfaces of theſe bones are largeſt nd, the figure of the whole conjoined t be convex there, and concave before ; h concavity is ſtill more increaſed by the *iſiforme*, and proceſs of the *os unciforme*, ding forewards on one ſide, as the *tra- m* does on the other : And the bones are rely kept in this form, by the broad ſtrong ſverſe ligament connected to theſe parts hem that ſtand prominent into the palm e hand.———The convexity behind ren- the whole fabric ſtronger, where it is expoſed to injuries; and the large an- r hollow is neceſſary for a ſafe paſſage to numerous veſſels, nerves, and tendons of ngers.

e ſubſtance of theſe bones is ſpongy cellular, but ſtrong in reſpect of their

e three firſt bones of the *carpus* make an g head, by which they are articulated the cavity at the lower ends of the bones e fore arm ; ſo as to allow motion to des, and, by a quick ſucceſſion of theſe ons, they may be moved in a circle. But joint is oblong, and therefore the two nſions are unequal, no motion is allowed e *carpus* round its axis, except what it has

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Galen. de uſu part. lib. 2. cap. 8. For a particular de- n of theſe ligaments, ſee Weitbrecht. Syndeſmolog. 68.

has in the pronation and ſupination along
the *radius*.——The articulation of the
three bones of the ſuperior row, with
bones of the inferior, is ſuch as allows of
tion, eſpecially backwards and forewards
the ſecurity and eaſineſs of which the re
tion of the *os magnum* into the cavity for
by the *ſcaphoides* and *lunare* contributes c
derably: And the greateſt number of
muſcles that ſerve for the motion of the
on the *radius*, being inſerted beyond the
junction of the firſt row of bones with th
cond, act equally on this articulation as
do on the former; but the joint formed
the *radius* being the moſt eaſily moved
firſt effect of theſe muſcles is on it; an
ſecond row of the *carpus* is only moved
wards. By this means a larger motion o
wriſt is allowed, than otherwiſe it could
had ſafely: For, if as large motion had
given to one joint, the angle of flection w
have been very acute, and the ligaments
have been longer than was conſiſtent wi
firmneſs and ſecurity of the joint.——
other articulations of the bones here
by nearly plain ſurfaces, ſcarce allow o
more motion, becauſe of the ſtrong
necting ligaments, than to yield a little
ſo elude the force of any external p
and to render the back of the wriſt a
more flat, or the palm more hollow, o
per occaſions. The articulations o
thumb and metacarpal bones ſhall be e
ned afterwards.

he uſes of the *carpus* are to ſerve as a baſe
e hand, to protect its tendons, and to af-
it a free large motion.

ll the bones of the *carpus* are in a cartila-
us ſtate at the time of birth.

n account of the many tendons that paſs
the lower end of the fore-arm and the
us, and of the numerous ligaments of theſe
ons and of the bones, which have lubrica-
liquors ſupplied to them, the pain of ſprains
is acute, the parts take long time to reco-
heir tone, and their ſwellings are very ob-
e.

ETACARPUS * conſiſts of four bones
h ſuſtain the fingers.———Each bone is
and round, with its ends larger than its
.—The upper end, which ſome call the
is flat and oblong, without any conſider-
head or cavity; but it is however ſome-
hollowed, for the articulation with the
s: It is made flat and ſmooth on the ſides
e theſe bones are contiguous to each other.
Their bodies are flatted on their back-part
e tendons of the extenſors of the fingers.
The anterior ſurface of theſe bodies is a
concave, eſpecially in their middle; along
a ſharp ridge ſtands out, which ſeparates
uſculi interoſſei placed on each ſide of theſe
which are there made flat and plain by
muſcles.

eir lower ends are raiſed into large ob-
ſmooth heads, whoſe greateſt extent is
ards from the axis of the bone.—At the
fore-

τής, προκαρπιον, στῆθος, ἄνδηρον, κτενίον, poſtbrachiale,
palma. pecten.

fore-part of each ſide of the root of ea
theſe heads, one or two tubercles ſtand out
fixing the ligaments that go from one met
pal bone to another, to preſerve them fro
ing drawn aſunder :—Round the heads a r
ring may be remarked, for the capſular
ments of the firſt joints of the fingers to b
ed to ; and both ſides of theſe heads are
by preſſing on each other.

The ſubſtance of the metacarpal bones i
ſame with that of all long bones.

At the time of birth, theſe bones are
laginous at both ends, which afterwards be
epiphyſes.

The metacarpal bones are joined abo
the *oſſa carpi* and to each other by nearly
ſurfaces. Theſe connections are not fit for
motions.——The articulation of their
heads at the lower ends with the cavit
the firſt bones of the fingers, is to be take
tice of hereafter.

The concavity on the fore-part of theſ
tacarpal bones, and the placing their ba
the arched *carpus*, cauſe them to form a h
in the palm of the hand, which is uſeful
to us.—The ſpaces between them lodge m
and their ſmall motion makes them fit ſu
ers for the fingers to play on.

Though the *oſſa metacarpi* ſo far agre
they may be diſtinguiſhed from each ot
the following marks.

The *os metacarpi indicis* is generall
longeſt.—Its baſe, which is articulated wi

trapezoides, is hollow in the middle.——The
all ridge on the internal ſide of this oblong
vity is ſmaller than the one oppoſite to it,
d is made flat on the ſide by the *trapezium*.
—The exterior ridge is alſo ſmooth, and flat
its outſide, for its conjunction with the *os*
gnum; immediately below which a ſemicir-
lar ſmooth flat ſurface ſhews the articulation
this to the ſecond metacarpal bone.——The
ck-part of this baſe is flatted; where the long
ad of the *extenſor carpi radialis* is inſerted; and
fore-part is prominent, where the tendon of
e *flexor carpi radialis* is fixed.—The external
e of the body of this bone is more hollowed
the action of muſcles, than the internal.—
e tubercle at the internal root of its head
larger than the external.—Its baſe is ſo firm-
fixed to the bone it is connected with, that
has no motion.

Os metacarpi medii digiti is generally the ſe-
nd in length; but often it is as long as the
mer; ſometimes it is longer; and frequent-
it appears only to equal the firſt by the *os*
gnum being farther advanced downwards
an any other bone of the wriſt.——Its baſe
a broad ſuperficial cavity, ſlanting outwards;
e internal poſterior angle of which is ſo pro-
nent, as to have the appearance of a proceſs.
—The internal ſide of this baſe is made plain
the ſame way as the external ſide of the for-
r bone, while its external ſide has two hol-
w circular ſurfaces, for joining the third meta-
pal bone, and between theſe ſurfaces there is
ough *foſſa*, for the adheſion of a ligament,
d lodging mucilaginous glands.—The ſhort-

er head of the *bicornis* is inſerted into t back-part of this baſe.——The two ſides of t bone are almoſt equally flatted; only the ri on the fore-part of the body inclines outwar ——The tubercles at the fore-part of the r of the head are equal.——The motion of t bone is very little more than the firſt metac pal one has; and therefore theſe two firmly fiſt bodies preſſed againſt them by the thum or figures, or both.

Os metacarpi digiti annularis is ſhorter t the ſecond metacarpal bone.——Its baſe is micircular and convex, for its conjunction w the *os unciforme*.——On its internal ſide two ſmooth convexities, and a middle *foſſa,* apted to the ſecond metacarpal bone.—T external ſide has a triangular ſmooth conc ſurface to join it with the fourth one. The terior ridge of its body is ſituated more to out than to the in-ſide.——The tubercles n the head are equal.—The motion of this th metacarpal bone is greater than the motion the ſecond.

Os metacarpi minimi digiti is the ſmalleſt a ſharpeſt.——Its baſe is irregularly convex, a riſes ſlanting outwards.— Its internal ſide is e actly adapted to the third metacarpal bone— The external has no ſmooth ſurface, becauſe is not contiguous to any other bone; but it prominent where the *extenſor carpi ulnaris* inſerted. — As this *metacarpal* bone is furniſh with a proper moving muſcle, has the plain articulation, is moſt looſely connected and le confined, it not only enjoys a much larger moti than any of the reſt, but draws the third bo

wi

ith it, when the palm of the hand is to be
ade hollow by its advancement forewards, and
the prominence of the thumb oppoſite to

The *THUMB* and four *FINGERS* are each
mpoſed of three long bones.

The *Thumb* * is ſituated obliquely in reſpect
the fingers, neither oppoſite directly to
em, nor in the ſame plane with them.——All
bones are much thicker and ſtronger in
oportion to their length, than the bones of
fingers are: Which was extremely ne-
ſſary, ſince the thumb counteracts all the
gers.

The firſt bone of the thumb has its baſe
apted to the double pulley of the *trapezi-*
i: For, in viewing it from one ſide to the o-
er, it appears convex in the middle; but
hen conſidered from behind forewards, it is con-
ve there.——The edge at the fore-part of
is baſe is produced farther than any other
rt; and round the back-part of the baſe a
ugh *foſſa* may be ſeen, for the connection of
ligaments of this joint.——The body and
ad of this bone are of the ſame ſhape as the
a metacarpi; only that the body is ſhorter,
d the head flatter, with the tubercles at the
e-part of its root larger.

The articulation of the upper end of this
ne is uncommon: For though its has protu-
rances and depreſſions adapted to the double
lley of the *trapezium*; yet it enjoys a circu-
motion, as the joints do where a round
ad of one bone plays in the orbicular ſocket

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* Ἀντίχειρ, δικόνδυλος, magnus digitus, promanus.

of another; only it is ſomewhat more confin
and leſs expeditious, but ſtronger and more ſ
cure, than ſuch joints generally are.

This bone of children is in the ſame ſta
with the metacarpal bones.

The ſecond bone of the thumb has a lar
baſe formed into an oblong cavity, who
greateſt length is from one ſide to the othe
—Round it ſeveral tubercles may be remar
ed, for the inſertion of ligaments.—— Its bo
is convex, or a half round behind; but flat b
fore, for lodging the tendon of the long flex
of the thumb, which is died down by ligame
tous ſheaths that are fixed on each ſide to the a
gle at the edge of this flat ſurface.—The low
end of this ſecond bone has two lateral rou
protuberances, and a middle cavity, who
greateſt extent of ſmooth ſurface is foreward

The articulation and motion of the upp
end of this ſecond bone is as ſingular as that
the former.—For its cavity being joined to t
round head of the firſt bone, it would ſeem
firſt view to enjoy motion in all direction
yet, becauſe of the ſtrength of its lateral li
ments, oblong figure of the joint itſelf, a
mobility of the firſt joint, it only allows fl
tion and extenſion; and theſe are genera
much confined.

The third bone of the thumb is the ſmall
with a large baſe, whoſe greateſt extent
from one ſide to the other.——This baſe
formed into two cavities and a middle p
berance, to be adapted to the pulley of the f
mer bone.——Its body is rounded behind;

flatter than in the former bone, for ſuſtain-
g the nail.——It is flat and rough before,
the inſertion of the *flexor tertii internodii*.
—This bone becomes gradually ſmaller, till
ar the lower end, where it is a little enlar-
d, and has an oval ſcabrous edge.

The motion of this third bone is confined to
ction and extenſion.

The orderly diſpoſition of the bones of the
gers into three rows, has made them gene-
lly obtain the name of three *phalanges* §.
—All of them have half round convex ſur-
es, covered with an *aponeuroſis*, formed by
tendons of the *extenſors*, *lumbricales*,
interoſſei, and placed directly backwards,
their greater ſtrength, and their flat con-
e part is forewards, for taking hold more
ely, and for lodging the tendons of the
xor muſcles.——The ligaments for keep-
down theſe tendons are fixed to the angles
t are between the convex and concave
s.

he bones of the firſt *phalanx* * of the fin-
s anſwer to the deſcription of the ſecond
e of the thumb: only that the cavity in
r baſe is not ſo oblong; nor is their mo-
on the metacarpal bones ſo much confi-
: for they can be moved laterally or circu-
y, but have no rotation or a very ſmall
ee of it round their axis.

oth the ends of this firſt *phalanx* are in
rtilaginous ſtate at the birth; and the up-

Scytalidæ, internodia, ſcuticula, agmina, acies, condyli
li.

Προκονδυλοι,

per one is afterwards affixed in form of an ep phyſe.

The ſecond bone * of the fingers has i baſe formed into two lateral cavities, and middle protuberance; while the lower e has two lateral protuberances and a middle c vity; therefore it is joined at both ends in t ſame manner, which none of the bones of t thumb are.

This bone is in the ſame condition with t former in children.

The third bone † differs nothing from t deſcription of the third bone of the thum excepting in the general diſtinguiſhing mark and therefore the ſecond and third *phala* of the fingers enjoy only flection and exte ſion.

The upper end of this third *phalanx* i cartilage in a ripe child; and is only an e *phyſe* after, till the full growth of the dy.

All the difference of the *phalanges* of ſeveral fingers conſiſts in their magnitude.— The bones of the *middle finger* ‡ being longeſt and largeſt,——thoſe of the *f finger* ‖ come next to that in thickneſs, but in length, for thoſe of the *ring-finger* ** a little longer. The *little-finger* †† has ſma

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* Κονδυλοι.

† Μετακονδυλοι, ῥιζωνυχια.

‡ Καταπυγων, σφακελος, infamis, impudicus, verpus, moſus, obſcænus

‖ Δεικτικος, indicator, λιχανος, demonſtrativus, ſaluta

** Ἰατρικος, παραμεσος, δακτυλιώτης, επιβατης, ann medicus, cordis digitus.

†† Μυωψ, ωτίτης, auricularis, minimus.

alleſt bones. Which diſpoſition is the beſt
ntrivance for holding the largeſt bodies; be-
uſe the longeſt fingers are applied to the
iddle largeſt periphery of ſuch ſubſtances as
e of a ſpherical figure (*a*).

The uſes of all the parts of our *ſuperior ex-
mities* are ſo evident in the common actions
life, that it is needleſs to enumerate them
re; and therefore I ſhall proceed to the laſt
rt of the ſkeleton. Only, leſt I ſhould ſeem
have forgot the ſmall bones at the joints of
e hand, I deſire now to refer to the deſcrip-
n of them, under the common title of *ſe-
moid bones*, which I have placed after the
nes of the feet.

F THE INFERIOR EXTREMITIES.

HE *INFERIOR EXTREMITIES*
depend from the *acetabula* of the *oſſa
nominata*; are commonly divided into three
rts, *viz.* the thigh, leg, and foot.

The *THIGH* * has only one bone; which
the longeſt of the body, and the largeſt and
ongeſt of any of the cylindrical bones. The
uation of it is not perpendicular: for the low-
end is inclined conſiderably inwards; ſo that
e knees are almoſt contiguous, while there is
onſiderable diſtance between the thigh-bones
ove: which is of good uſe to us, ſince ſuffici-
t ſpace is thereby left for the external parts of
gene-

(*a*) Galen de uſu part. lib. 1. cap. 24.

* Μηρὸν, femen, coxa, agis, anchæ os, crus, femur.

generation, the two great *cloacæ* of urine a
fœces, and for the large thick muſcles th
move the thigh inwards : and at the ſame ti
this ſituation of the thigh-bones renders o
progreſſion quicker, ſurer, ſtreighter, and
leſs room ; for had the knees been at a grea
diſtance from each other, we muſt have be
obliged to deſcribe ſome part of a circle wi
the trunk of our body in making a long ſt
and, when one leg was raiſed from the grou
our center of gravity would have been too f
from the baſe of the other, and we ſhould co
ſequently have been in hazard of falling;
that our ſteps would neither have been ſtrei
nor firm; nor would it have been poſſible
walk in a narrow path, had our thigh-bo
been otherwiſe placed. In conſequence, how
ver, of the weight of the body bearing ſo o
liquely on the joint of the knee, by this ſitu
tion of the thigh-bones, weak rickety ch
dren become in-knee'd.

The upper end of the thigh-bone is n
continued in a ſtreight line with the body
it, but is ſet off obliquely inwards and upwar
whereby the diſtance here between theſe t
bones at their upper part is conſiderably i
creaſed.———This end is formed into a lar
ſmooth round head *, which is the greater p
tion of a ſphere unequally divided.—Towar
its lower internal part a round rough ſpongy
is obſerveable, where the ſtrong ligament, co
monly, but unjuſtly, called the *round* one,
fixed, to be extended from thence to the low
intern

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* Vertebrum.

ternal part of the receiving cavity, where it conſiderably broader than near to the head the thigh-bone.———The ſmall part below e head, called the *cervix*, of the *os femoris*, s a great many large holes into which the res of the ſtrong ligament, continued from capſular, enter, and are thereby ſurely uni- to it; and round the root of the neck, ere it riſes from the bone, a rough ridge is und, where the capſular ligament of the ar- ulation itſelf is connected.———Below the k-part of this root, the large unequal pro- erance, called *trochanter major* ‡, ſtands ; the external convex part of which is diſ- guiſhed into three different ſurfaces, where- the one on the fore-part is ſcabrous and gh, for the inſertion of the *glutæus mini- ;* the ſuperior one is ſmooth, and has the *æus medius* inſerted into it; and the one ind is made flat and ſmooth by the tendon the *glutæus maximus* paſſing over it.—The er edge of this proceſs is ſharp and pointed its back-part, where the *glutæus medius* is d; but forewards it is more obtuſe, and has ſuperficial pits formed in it: Into the ſupe- of theſe, the *piriformis* is implanted; and *obturator internus* and *gemini* are fixed into lower one.——From the backmoſt promi- t part of this great *trochanter*, a rough e runs backwards and downwards, into ch the *quadratus* is inſerted.———In the p hollow, at the internal upper ſide of this e, the *obturator externus* is implanted.——

More

Γλουτὸς, rotator natis, malum granatum teſticulorum.

More internally, a conoid proceſs, called t *chanter minor* *, riſes for the inſertion of t *muſculus pſoas*, and *iliacus internus*, and t *pectineus*, is implanted into a rough hollow b low its internal root.——The muſcles inſer into theſe two proceſſes being the principal ſtruments of the rotatory motion of the thi have occaſioned the name of *trochanters* to proceſſes.——The tendons that are fixed in or paſs over the great *trochanter*, cauſe brui by falls on this part to be attended with gr pain and weakneſs of the limb, which ge rally remain long.

The body of the *os femoris* is convex on fore-part, and made hollow behind, by action of the muſcles that move it and leg, and for the conveniency of ſitting, w out bearing too much on theſe muſcles; probably the weight of the legs depend from the thighs in that poſture contrib to this curvature.——The fore-part of thigh-bone is a little flatted above by the ginning of the *cruræus* muſcle, as it is alſo low by the ſame muſcle and the *rectus*.— Its external ſurface is likewiſe made flat be by the *vaſtus externus*, where it is ſepar from the former by an obtuſe ridge.—— *vaſtus internus* depreſſes a little the lower of the internal ſurface.——The poſterior c cave ſurface has a ridge riſing in its middle c monly called *linea aſpera*, into which the *tri* is inſerted, and the ſhort head of the *biceps* *or tibiæ* riſes from it.——At the upper par it the medullary veſſels enter by a ſmall

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* Rotator minor.

t runs obliquely upwards.——A little above
ich there is a rough *foſſa* or two, where the
don of the *glutæus maximus* is fixed.———
e lower end of the *linea aſpera* divides into
o, which deſcend towards each ſide.——The
vaſti muſcles have part of their origin
m theſe ridges; and the long tendon of
triceps is fixed to the internal, by means
part of the *faſcia aponeurotica* of the thigh.
—Near the beginning of the internal ridge,
e is a diſcontinuation of the ridge, where
crural artery paſſes through the *aponeuroſis*.
etween theſe two rough lines, the bone
made flat by the large blood-veſſels and
es which paſs upon it; and near the end
ach of theſe ridges, a ſmall ſmooth protu-
nce may often be remarked, where the two
ds of the external *gaſtrocnemius* muſcle take
r riſe, and where ſeſamoid bones are ſome-
s found (*a*); and from the fore-part of the
nal tubercle, a ſtrong ligament is extended
e inſide of the *tibia*.

he lower end of the *os femoris* is larger
any other part of it, and is formed into
eat protuberance on each ſide, called its
yles; between which a conſiderable cavity
ound, eſpecially at the back-part, in which
crural veſſels and nerves lie immerſed in
——The internal condyle is longer than
external, which muſt happen from the
ue poſition of this bone, to give leſs ob-
ty to the leg.——Each of theſe proceſ-
eems to be divided in its plain ſmooth
ce. The mark of diviſion on the exter-
nal

Veſal. lib. 1. cap. 28. & 30.

nal is a notch, and on the internal a ſmall p
tuberance. The fore-part of this diviſion,
which the *rotula* moves, is formed like a p
ley, the external ſide of which is higheſt.—
Behind, there are two oblong large he
whoſe greateſt extent is backwards, for
motion of the *tibia*; and from the rough
vity between them, but near to the baſe of
internal condyle, the ſtrong ligament c
monly called the *croſs* one, has its riſe.—
little above which a rough protuberance g
inſertion to the tendon of the *triceps*.——
The condyles, both on the outer and in
ſide of the knee are made flat by the muſ
paſſing along them.——On the back-part of
internal, a ſlight depreſſion is made by
tendons of the *gracilis* and *ſartorius*; and
the external ſuch another is formed by the
ceps flexor cruris; behind which a deep *foſſ*
to be obſerved, where the *poplitæus* muſcle
its origin.——From the tubercle immedia
before this cavity, a ſtrong round ligam
goes out to the upper part of the *fibula*.—
Round this lower end of the thigh-bone, l
holes are found, into which the ligaments
the ſecurity of the joint are fixed, and bl
veſſels paſs to the internal ſubſtance of
bone.

All the proceſſes of the *femur* are c
laginous in new-born children, and afterw
become ſmall *apophyſes*, with large *ep*
ſes.

The thigh-bone being articulated above
the *acetabulum* of the *oſſa innominata*, w
affords its round head a ſecure and exte

F

play, can be moved to every ſide; but is reſtrained in its motion outwards, by the high brims of the cavity, and by the *round* ligament; for otherwiſe the head of the bone would have been frequently thruſt out at the breach of the brims on the inſide, which allows the thigh to move conſiderably inwards. ———The body of this bone enjoys little r no rotatory motion, though the head moſt ommonly moves round its own axis; becauſe he oblique progreſs of the neck and head rom the bone is ſuch, that the rotatory mo-ion of the head can only bring the body of he bone forewards and backwards: Nor is this ead, as in the arm, ever capable of being rought to a ſtreight direction with its body; o far however as the head can move within he cavity backwards and forewards, the reſt of e bone may have a partial rotation.——— When the thigh-bone reſiſts the actions of s muſcles more than the trunk of the body an then do, as in ſtanding, theſe muſcles have eir effect on the trunk, cauſing it to bend fore-ard, raiſing it up, inclining it to the one or e other ſide, twiſting it obliquely, &c. which e rolling of the *acetabula* of the *oſſa innomi-ata* on the round heads of the thigh-bones is ell fitted for.———The *os femoris* is articu-ted below to the *tibia* and *rotula* in the man-r afterwards to be deſcribed.

The nearneſs of the ſmall neck to the round ad of the thigh-bone, and its upper end be-g covered with very thick muſcles, make eater difficulty in diſtinguiſhing between a

luxation and fracture here, than in any othe
part of the body.

The *LEG* * is compoſed, according to th
common account, of two bones, *tibia* and *f*
bula, though it ſeems to have a very good titl
to a third, the *rotula*; which bears a ſtrong
nalogy to the *olecranon* of the *ulna*, and move
always with the other two.

TIBIA †, ſo called from its reſemblance
an old muſical pipe cr flute, is the long thi
triangular bone, ſituated at the internal part
the leg, and continued in almoſt a ſtreight li
from the thigh-bone.

The upper end of the *tibia* is large, bu
bous, and ſpongy, and is divided into tw
cavities, by a rough irregular protuberance
which is hollow at its moſt prominent pa
as well as before and behind. The anteri
of the two ligaments that compoſe the gre
croſs one, is inſerted into the middle ca
ty, and the depreſſion behind receives
poſterior ligament.——The two broad ca
ties at the ſides of this protuberance are
equal; for the internal is oblong and de
to receive the internal *condyle* of the thig
bone; while the external is more ſuperfic
and rounder, for the external *condyle*.——
In each of theſe two cavities of a recent ſ
ject, a ſemilunar cartilage is placed, which
thick at its convex edge, and becomes g
dua

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[*] Κνήμη, crus, tibia.

[†] Προκνήμιον, ὀντικνήμιον, focile majus, arundo m
canna major, canna domeſtica cruris.

[‡] Διαφυσις, ἐξοχὴ νευροχονδρῶδης. tuber, tuberculum.

ſually thinner towards the concave or interior
dge.———The middle of each of theſe car-
ilages is broad, and the ends of them turn
arrower and thinner, as they approach the
iddle protuberance of the *tibia.*———The
hick convex edge of each cartilage is con-
ected to the capſular and other ligaments of
he articulation, but ſo near to their riſe from
he *tibia*, that the cartilages are not allowed
o change place far; while the narrow ends
f the cartilages becoming almoſt ligaments,
re fixed at the inſertion of the ſtrong croſs
igament into the *tibia*, and ſeem to have their
ubſtance united with it; therefore a circular
ole is left between each cartilage and the li-
ament, in which the moſt prominent convex
art of each condyle of the thigh-bone moves.
——The circumference of theſe cavities is
ough and unequal for the firm connection
f the ligaments of the joint.———Immedi-
tely below the edge at its back-part, two
ough flatted protuberances ſtand out: Into the
ternal, the tendon of the *ſemimembranoſus*
uſcle is inſerted; and a part of the croſs li-
ament is fixed to the external.———On the
utſide of this laſt tubercle, a ſmooth ſlightly-
ollowed ſurface is formed by the action of the
pliteus muſcle.

Below the fore part of the upper end of
e *tibia*, a conſiderable rough protuberance
riſes, to which the ſtrong tendinous liga-
ent of the *rotula* is fixed. ——On the internal
de of this, there is a broad ſcabrous ſlightly-

hollowed

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* Ἀντικνήμιον, anterior tuber.

hollowed ſurface, to which the internal lon
ligament of the joint, the *aponeuroſis* of th
vaſtus internus, and the tendons of the *ſemi*
nervoſus, *gracilis*, and *ſartorius*, are fixed.—
The loweſt part of this ſurface is therefore th
place where the *tibia* ought to be ſawed thr
in an amputation, ſo as not to have too lon
and troubleſome a ſtump, and, at the ſam
time, to preſerve its motions, by ſaving the pr
per muſcles.———Below the external edge o
the upper end of the *tibia*, there is a circul
flat ſurface, covered in a recent ſubject wit
cartilage, for the articulation of the *fibula*
———between which and the anterior kno
there is a rough hollow from which the *tibial*
anticus, and *extenſor digitorum longus*, tak
their origin.————From the ſmooth flat ſu
face, a ridge runs obliquely downwards a
inwards, to give riſe to part of the *ſolæus*, *ti*
alis poſticus, and *flexor digitorum longus*, and i
ſertion to the *aponeuroſis* of the *ſemimembran*
ſus which covers the *poplitæus*, and to ſome
the external fibres of this laſt named muſcl
——At the inſide of this ridge an obliqu
plain ſurface is left, where the greateſt pa
of the *muſculus poplitæus* is inſerted.——T
remaining body of the *tibia* is triangular.—
The anterior angle is very ſharp, and is com
monly called the *ſpine* or *ſhin* †. This rid
is not ſtreight; but turns firſt inwards, th
outwards, and laſtly inwards again.———T
plain internal ſide is ſmooth and equal, bei
little ſubjected to the actions of muſcles; b
t

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† Ακανθα, ſpina, crea, linea prima tibiæ, angulus acutus.

external ſide is hollowed above by the
ialis anticus, and below by the *extenſor*
itorum longus and *extenſor pollicis longus*,
—The two angles behind theſe ſides are
inded by the action of the muſcles;—the po-
ior ſide comprehended between them is
t ſo broad as thoſe already mentioned, but is
re oblique and flatted by the action of the
ialis poſticus and *flexor digitorum longus*.——
ne way above the middle of the bone, the
ernal angle terminates, and the bone is
de round by the preſſure of the *muſculus*
us.—Near to this, the paſſage of the medul-
y veſſels is ſeen ſlanting obliquely down-
rds.

The lower end of the *tibia* is made hollow,
t ſo as a ſmall protuberance riſes in the
ddle.——The internal ſide of this cavity,
ich is ſmooth, and, in a recent ſubject,
covered with cartilage, is produced into a
nſiderable proceſs, commonly named *mal-*
lus internus *; the point of which is divi-
d by a notch, and from it ligaments are
t out to the foot.——We ought to obſerve
e, that this internal *malleolus* is ſituated
re forewards than the internal condyle of
upper end of this bone; which is neceſſary
be remembered in reducing a fracture of
leg (*a*).———The external ſide of this end
the *tibia* has a rough irregular ſemilunar ca-

Σφυρὸν, πεσον, talus, clavicula, clavilla interior, clavilla do-
ſica.

) Winſlow, Expoſition anatomique, des os ſecs, ſect.
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vity formed in it, for receiving the lower e of the *fibula*.— The poſterior ſide has t lateral grooves, and a ſmall middle protub rance. In the internal depreſſion, the te dons of the *muſculus tibialis poſticus* and *fle* *digitorum longus* are lodged; and in the ext nal, the tendon of the *flexor longus polli* plays.——From the middle protuberance, li mentous ſheaths go out, for tying down th tendons.

The articulations and motions of the *ti* ſhall be explained, after all the three bones the leg are deſcribed.

Both the ends of the *tibia* are cartila at birth, and become afterwards *epip* *ſes*.

FIBULA[*] is the ſmall long bone, pla on the outſide of the leg, oppoſite to the ternal angle of the *tibia*; the ſhape of it is regularly triangular.

The head of the *fibula* has a ſuperficial cular cavity formed on its inſide, which, i recent ſubject, is covered with a cartilage, ſo cloſely connected to the *tibia* by ligame as to allow only a ſmall motion backwards forewards.——This head is protuberant rough on its outſide, where a ſtrong round gament and the *muſculus biceps* are inſert and, below the back-part of its internal ſ a tubercle may be remarked, that gives to the ſtrong tendinous part of the *ſol* muſcle.

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[*] Παρακνήμιον, perone, focile minus, arundo minor, c minor cruris, ſura, radius.

The body of this bone is a little crooked wards and backwards, which figure is ow- g to the actions of the muſcles ; but is ſtill rther increaſed by nurſes, who often hold hildren careleſsly by the legs.——The ſharp- t angle of the *fibula* is forewards, on each de of which the bone is conſiderably but equally depreſſed by the bellies of the ſe- ral muſcles that riſe from, or act upon it ; d, in old people, theſe muſcles make di- nct ſinuoſities for themſelves. —— The ex- rnal ſurface of the *fibula* is depreſſed oblique- from above downwards and backwards, by e two *peronæi.* —— Its internal ſurface is equally divided into two narrow longitudinal anes, by an oblique ridge extended from e upper part of the anterior angle, to join ith the lower end of the internal angle. o this ridge the ligament ſtretched between e two bones of the leg is connected.——— he anterior of the two planes is very nar- w above, where the *extenſor longus digi- um* and *extenſor longus pollicis* ariſe from ; but is broader below, where it has the int of the *nonus Veſalii.* —— The poſterior ane is broad and hollow, giving origin to e larger ſhare of the *tibialis poſticus* —— he internal angle of this bone has a tendi- us membrane fixed to it, from which fibres the *flexor digitorum longus* take their riſe. —— The poſterior ſurface of the *fibula* is e plaineſt and ſmootheſt, but is made flat ove by the *ſolæus,* and is hollowed below by e *flexor pollicis longus.* —— In the middle of this ſurface the canal for the medullary veſſe may be ſeen ſlanting downwards.

I have taken particular notice of the e try and direction of the medullary veſſels the large bones of the extremities (a); b cauſe, in ſeveral chirurgical caſes, a ſurgeo who is ignorant of this, may do miſchief his patient. Thus, for example, if theſe ve ſels are opened very near to their entry in the bone, or while they are in the obliq paſſage though it, an obſtinate hæmorrhagy ma enſue: For the arteries being connected to t bony paſſage, ſtyptics, and other like co rugators, are vainly applied; compreſſing i ſtruments can do no ſervice, and ligatures ca not be employed.——There ſeems to be a pa ticular deſign in the contrivance of theſe c nals; thoſe in the *os humeri*, *tibia*, and *fi* *la*, running obliquely downwards from their e ternal entry; whereas in the *radius*, *uln* and *os femoris*, they ſlant upwards, where the arteries and nerves which are ſent in theſe three laſt bones, muſt ſuffer a conſid able reflection before they come at the *cance* The reaſon of this diverſity may perhaps b that the arteries which are ſo ſmall within t bones as to have no ſtrong contractile prop ling force in their coats, and where they a not aſſiſted by the action of any moving neig bouring organ, ſhould have, at leaſt in th paſſage through the bone, a favourable deſce for their liquids: Which, it is evident, th have in the deſcending oblique paſſages form for them in the firſt claſs of bones, to wit, t

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(a) Havers, Oſteolog. nov. diſc. 1. p. 59.

umeri, tibia, and *fibula,* which are gene-
y depending; and they alſo moſt frequently
uire the like advantage in the *radius, ulna,*
os femoris, becauſe the hand, in the moſt
ural poſture, is higher than the elbow;
when we ſit or lie, the lower end of the
h-bone comes to be at leaſt as high raiſed
the upper. In ſtanding and walking, or
n the arms are moved, the blood muſt in-
d aſcend as it paſſes through the bones of
fore-arm and thigh; but the preſſure of
muſcles, then in action, on the veſſels,
re they enter the bones, is ſufficient to
penſate the diſadvantage of their courſe.
s reaſoning ſeems to be ſtill enforced, by
rving, that this paſſage is always nearer
upper than the lower ends of theſe
es.

he lower end of the *fibula* is extended
a ſpongy oblong head, on the inſide of
ch is a convex, irregular, and frequently
cabrous ſurface, that is received by the
rnal hollow of the *tibia,* and ſo firmly
ed to it by a very thin intermediate car-
ge and ſtrong ligaments, that it ſcarce can
e.—Below this, the *fibula* is ſtretched out
a coronoid proceſs, that is ſmooth, covered
h cartilage on its internal ſide, and is there
tiguous to the outſide of the firſt bone of the
, the *aſtragalus,* to ſecure the articula-
. This proceſs, named *malleolus externus,*
g ſituated farther back than the internal
leolus, and in an oblique direction, obliges
aturally to turn the fore-part of the foot
outwards

outwards (*a*). At the lower internal part this proceſs, a ſpongy cavity for mucilagin glands may be remarked ; from its point gaments are extended to the *aſtragalus*, *calcis*, and *os naviculare*, bones of the fo and from its inſide ſhort ſtrong ones go to the *aſtragalus*. On the back part of ſinuoſity is made by the tendons of the *ronæi* muſcles.——When the ligament tended over theſe tendons from the one of the depreſſion to the other is broke, ſtret ed too much, or made weak by a ſprain, tendons frequently ſtart forewards to the ſide of the *fibula*.

The conjunction of the upper end of *fibula* with the *tibia* is by plain ſurfaces ped with cartilage, and at its lower end cartilage ſeems to glue the two bones toget not, however, ſo firmly in young people, that the motion at the other end of ſuc long *radius* is very obſerveable—— In old jects I often ſee the two bones of the leg gro together at their lower ends.

The principal uſe of this bone is to aff origin and inſertion to muſcles; the direct of which may be a little altered on proper caſions, by its upper part ſhuffling backwa and forewards.——It likewiſe helps to make articulation of the foot more ſecure and fi ——The ends of the *tibia* and *fibula* be larger than their middle, a ſpace is here l which is filled up with ſuch another ligam as I deſcribed extended between the bones

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(*a*) Winſlow, Memoires de l'acad. des ſciences, 1722.

fore-arm; and which is alſo diſcontinued at upper part, where the *tibialis anticus* immeely adheres to the *ſolæus* and *tibialis poſti-*; but every where elſe it gives origin to ſcular fibres (*a*).

oth the ends of this bone are cartilaginous ripe child, and aſſume the form of *appen*rbefore they are united to its body.

OTULA † is the ſmall flat bone ſituated e fore-part of the joint of the knee.—— ſhape reſembles the common figure of the t with its point downwards.——The anteconvex ſurface of the *rotula* is pierced by eat number of holes, into which fibres of ſtrong ligament that is ſpread over it en-—Behind, its ſurface is ſmooth, covered cartilage, and divided by a middle convex e into two cavities, of which the external rgeſt; and both are exactly adapted to the y of the *os femoris*, on which they are ed in the moſt ordinary unſtraining pos of the leg; but when the leg is much ded, the *rotula* deſcends far down on the dyles; and when the leg is fully extended, *rotula* riſes higher, in its upper part, than pulley of the thigh-bone.——The plain oth ſurface is ſurrounded by a rough promiedge, to which the capſular ligament ads:——Below, the point of the bone is ſcas, where the ſtrong tendinous ligament the tubercle of the *tibia* is fixed.—The upper

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) Weitbrecht, Syndeſmolog. p. 156.

'Επιμυλις, μυλακρις, κόγχος, επιγονατις, πλαυνησιεδρον a, mola, genu, ſcu i forme os, cartilaginoſum, diſci-, oculus genu.

upper horizontal part of this bone is flatted unequal, where the tendons of the exte of the leg are inſerted.

The ſubſtance of the *rotula* is cellular, very thin external firm plates : But then *cells* are ſo ſmall, and ſuch a quantity of is employed in their formation, that ſcarce bone of its bulk is ſo ſtrong. Beſides, it i vered all over with a thick ligament, (as it obſerved, that this ſort of bones generally to connect its ſubſtance, and is moveabl one ſide or other; therefore is ſuffici ſtrong to reſiſt the ordinary actions of the muſcles that are inſerted into it, or any mon external force applied to it; while a proceſs, ſuch as the *olecranon*, would not been ſufficient to bear the whole weight of bodies, which frequently falls on it, and w have hindered the rotatory motion of the Notwithſtanding theſe precautions to pre this bone from ſuch injuries, yet I have ſ tranſverſe fracture in it, when, by the r of the patient, and of the people about and by the want of ſwelling, diſcolourin other mark of bruiſe or contuſion, it was the bone was broken by the violent ſtra effort of the muſcles (*a*). Though my pa recovered the uſe of the joint of the yet I think it reaſonable to believe, that ſort of fracture is commonly attended difficulty of motion, after the broken par the *rotula* are reunited; becauſe the ca matter probably extends itſelf into the c of the joint, where it either grows to ſom

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(*a*) See Ruyſch. Obſerv. anat. chirurg. obſ. 3.

e parts or makes ſuch an inequality on the rface of this bone, as does not allow it to rform the neceſſary motions on the condyles f the *femur* (*a*).

At the ordinary time of birth, the *rotula* is tirely cartilaginous, and ſcarcely aſſumes a ony nature ſo ſoon as moſt *epiphyſes* do.

The parts which conſtitute the joint of the ee being now deſcribed, let us examine what e its motions, and how performed.——The o principal motions are flection and exten- n.———In the former of theſe, the leg may brought to a very acute angle with the igh, by the condyles of the thigh-bones ing round and made ſmooth far backwards. performing this, the *rotula* is pulled down the *tibia*.——When the leg is to be extend- , the *rotula* is drawn upwards, conſequent- the *tibia* forewards, by the *extenſor* muſcles; hich, by means of the protuberant joint, and this thick bone with its ligament, have in ect the chord, with which they act, fixed to e *tibia* at a conſiderable angle, therefore act ith advantage; but are reſtrained from pulling e leg farther than to a ſtreight line with the gh, by the poſterior part of the *croſs* liga- ent, that the body might be ſupported by a m perpendicular column: For at this time e thich and leg are as little moveable in a tatory way, or to either ſide, as if they were e continued bone.——But when the joint is little bended, the *rotula* is not tightly braced, d the poſterior ligament is relaxed; there- re this bone may be moved a little to either e, or with a ſmall rotation in the ſuperficial

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(a) Pare, liv. 15. cap. 22.

cavities of the *tibia*; which is done by the m
tion of the external cavity backwards and fo
wards, the internal ſerving as a ſort of axis (
Seeing then one part of the *croſs* ligament
ſituated perpendicularly, and the poſterior p
is ſtretched obliquely from the internal cond
of the thigh outwards, that poſterior part
the *croſs* ligament prevents the leg's be
turned at all inwards; but it could not hin
it from turning outwards almoſt round, was
that motion confined by the lateral ligame
of this joint, which can yield little. This
tation of the leg outwards is of good advant
to us in croſſing our legs, and turning our f
outwards, on ſeveral neceſſary occaſions; t
it is altogether fit this motion ſhould no
very large, to prevent frequent luxations h
———While all theſe motions are performi
the part of the *tibia* that moves immedia
on the condyles is only ſo much as is wi
the cartilaginous rings, which, by the thi
neſs on their outſides, make the cavities
the *tibia* more horizontal, by raiſing their
ternal ſide where the ſurface of the *tibia* ſl
downwards. By this means the motion
this joint are more equal and ſteady than ot
wiſe they would have been. The cartil
being capable of changing a little their ſi
tion, are fit for doing this good office in
different motions and poſtures of the mem
and likewiſe contribute to make the moti
larger and quicker.

On account of the very large ſurface of
bones forming the joint of the knee, and
m

(*a*) Winſlow, Expoſition anatomique du corps humain,
des os ſecs, § 976.

any ſtrong ligaments connecting them, lux-tions ſeldom happen here. But theſe very li-aments, the *aponeuroſis* paſſing over this int, the quantity of fat and mucilaginous lands neceſſary for lubricating it, make it ore ſubject to *white ſwellings*, dropſies, and ch other diſorders, than any other joint of e body.

The *FOOT* is divided, as well as the hand, to three parts, *viz.* *tarſus*, *metatarſus*, and *es*: In the deſcription of which, the ſeveral rfaces ſhall be named, according to their na-ral ſituation, *viz.* the *broad* of the foot, all be called ſuperior; the ſole, inferior; the de on which the great toe is, internal; that here the little toe is, external.

The *tarſus* † conſiſts of ſeven ſpongy bones; wit, the *aſtragalus*, *os calcis*, *naviculare*, *boides*, *cuneiforme externum*, *cuneiforme me-ium*, and *cuneiforme internum*.

The *aſtragalus* is the uppermoſt of theſe ones.——The *os calcis* is below the *aſtragalus*, nd is conſiderably prominent backwards eyond the other bones to form the heel. ——The *os naviculare* is in the middle of e internal ſide of the *tarſus*.——The *os boides* is the moſt external of the row of ur bones at its fore part————The *os neiforme externum* is placed at the inſide f the *cuboid*.——The *cuneiforme medium* is etween the *external* and *internal cuneiform* ones, and the *internal cuneiform* is put at the ternal ſide of the foot.

That the deſcription of theſe bones may not be

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† Raſſetta.

be immoderately ſwelled with repetition, I d ſire, once for all, to obſerve, That wherev a ridge is mentioned, without a particular u aſſigned, a ligament is underſtood to be fix to it: or where a ſpongy rough cavity, d preſſion, or *foſſa* is remarked, without nami its uſe, a ligament is inſerted, and mucila nous glands are lodged: For ſuch will occur the detail of each of theſe bones.

The upper part of the *aſtragalus* † is form into a large ſmooth head ‡, which is ſlight hollowed in the middle; and therefore r ſembles a ſuperficial pulley, by which it is fitt to the lower end of the *tibia*.——The intern ſide of this head is flat and ſmooth, to play the internal *malleolus*.——The external ſi has alſo ſuch a ſurface, but larger, for its ar culation with the external *malleolus*.——Rou the baſe of this head there is a rough *foſſ* and, immediately before the head, as alſo b low its internal ſmooth ſurface, we find a co ſiderable rough cavity.

The lower ſurface of the *aſtragalus* is di ded by an irregular deep rough *foſſa*; whi at its internal end is narrow, but gradua widens, as it ſtretches obliquely outwards a forewards.—The ſmooth ſurface, covered wi cartilage, behind this *foſſa*, is large, oblon extended in the ſame oblique ſituation with t *foſſa*, and concave, for its conjunction with t *os calcis*.——The back-part of the edge of t cavity is produced into two ſharp-pointed rou proceſſ roceſſes, between which is a depreſſion made y the tendon of the *flexor pollicis longus.*—— The lower ſurface before the *foſſa* is convex, nd compoſed of three diſtinct ſmooth planes. The long one behind, and the exterior or ſhorteſt, are articulated with the heel-bone; while the nternal, which is the moſt convex of the three, eſts and moves upon a cartilaginous ligament, hat is continued from the *calcaneum* to the *os caphoides.* Without which ligament, the *aſtragalus* could not be ſuſtained, but would be reſſed out of its place by the great weight it upports, and the other bones of the *tarſus* would be ſeparated. Nor would a bone be fit ere, becauſe it muſt have been thicker than ould conveniently be allowed; otherwiſe it would break, and would not prove ſuch an eaſy ending baſe, to leſſen the ſhock which is given o the body in leaping, running, &c.

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† Ἄςριος, talus, baliſtæ os, malleolus, chaib, quatrio, teſſaræ, claviculæ, nuciforme.

‡ Ιετρώρος.

The fore-part of this bone is formed into a onvex oblong ſmooth head, called by ſome ts proceſs, which is received by the *os naviculare.*—Round the root of this head, eſpecially on the upper ſurface, a rough *foſſa* may be emarked.

The *aſtragalus* is articulated above to the *tibia* and *fibula*, which together form one cavity. Though, in this articulation, the bones have rominencies and cavities ſo ſmall, as might llow motions in all directions; yet the flection nd extenſion are the moſt conſiderable, the ther motions being confined by the *malleoli*, nd by the ſtrong ligaments which go out from he points of theſe proceſſes to the *aſtragalus* nd *os calcis.*—When the foot is bended, ſo far as it is commonly when we ſtand, no lateral o rotatory motion is allowed in this joint; fo then the head of the *aſtragalus* is ſunk dee between the *malleoli*, and the ligaments ar tenſe ; but when the foot is extended, the *a ſtragalus* can move a little to either ſide, an with a ſmall rotation. By this contrivanc the foot is firm, when the weight of the bo dy is to be ſupported on it; and when a foot raiſed, we are at liberty to direct it more ex actly to the place we intend next to ſtep upon.— The *aſtragalus* is joined below, to the *os ca cis*; and before, to the *os naviculare*, in th manner to be explained, when theſe bones ar deſcribed.

A conſiderable ſhare of this bone is oſſifie in a new born infant.

Calcaneum * is the largeſt bone of the ſeve ——Behind, it is formed into a large kno commonly called the *heel*: The ſurface which is rough behind, where the *tendo Achill* is inſerted into it; and above, it is hollow an ſpongy. Farther forewards, on the upper ſurfa of the *calcaneum*, there is an irregalar oblon ſmooth convexity, adapted to the concavi at the back-part of the *aſtragalus*: And beyon this a narrow *foſſa* is ſeen, which divides it fro two ſmall concave ſmooth ſurfaces, that a joined to the fore-part of the *aſtragalus*.— Behind the poſterior of theſe ſmooth ſurface which is the largeſt, a ſmall ſinuoſity is made the tendon of the *flexor digitorum longu* at the fore-part of which a ſmall rough p tuberan uberance appears, that gives riſe to the *muſ- ulus extenſor digitorum brevis.*

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* Os calcis, πτέρνα, calcar pedis.

The external ſide of this bone is flat, with ſuperficial *foſſa* running horizontally, in hich the tendon of the *muſculus peronæus ngus* is lodged.———The internal ſide of the eel-bone is hollowed, for lodging the origin f the *maſſa cornea Jac. Sylvii*, and for the fe paſſage of tendons, nerves, and arteries. —Under the ſide of the internal ſmooth oncavity, a particular groove is made by the ndon of the *flexor pollicis longus*; and from e thin protuberance on this internal ſide, the rtilaginous ligament that ſupports the *aſtra- alus*, goes out to the *os naviculare*; on which gament, and on the edge of this bone to hich it is fixed, the groove is formed for the ndon of the *flexor digitorum profundus.*

The lower ſurface of this bone is preſſed flat the back-part, by the weight of our bodies; d immediately before this plane, there are o tubercles, from the internal of which the *uſculus abductor pollicis, flexor digitorum ſub- nis*, as alſo part of the *aponeuroſis plantaris*, d of the *abductor minimi digiti*, have their igin; and the other part of the *abductor mi- imi digiti* and *aponeuroſis plantaris* riſes from e external.———Before theſe protuberances is bone is concave, for lodging the flexor uſcles; and at its fore-part we may obſerve a ugh depreſſion, from which, and a tubercle hind it, the ligament goes out that prevents is bone to be ſeparated from the *os cuboides.*

The fore-part of the *os calcis* is formed into oblong pulley-like ſmooth ſurface, which is

circular at its upper external end, but is poi
ed below. This ſmooth ſurface is fitted to t
os cuboides.

Though the ſurfaces by which the *aſtragal*
and *os calcis* are articulated, ſeem fit enou
for motion; yet the very ſtrong ligaments
which theſe bones are connected, prevent
and render this principal part of our ba
which reſts on the ground, *to wit*, the *os calc*
firm.

A large ſhare of the heel-bone is oſſified
the ordinary time of birth, and the la
knob appears afterwards in form of an e
phyſe.

Os naviculare *, is ſomewhat circular.——
It is formed into an oblong concavity
hind for receiving the anterior head of
aſtragalus.——On the upper ſurface th
is a rough *foſſa*.———Below, the *os navicul*
is very unequal and rough; but hollow
the ſafety of the muſcles.———On its in
a large knob riſes out, from which
abductor pollicis takes in part its orig
the tendon of the *tibialis poſticus* is inſ
ed into it, and to it two remarkable li
ments are fixed; the firſt is the ſtrong o
formerly mentioned, which ſupports
aſtragalus; the ſecond is ſtretched from
bone obliquely croſs the foot, to the me
tarſal bones of the middle toe, and of
toe next to the little one.——On the o
ſide of the *os naviculare* there is a ſemicircu
ſmooth ſurface, where it is joined to the
cuboides.——The fore part of this bone is
cover

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* Σκαφοειδὴς, os cymbæ.

vered with cartilage, and is divided into ree ſmooth planes, fitted to the three *oſſa neiformia.*

The *os naviculare* and *aſtragalus* are joined a ball and ſocket, and the *naviculare* oves in all directions in turning the toes inrds, or in raiſing or depreſſing either ſide of e foot, though the motions are greatly reained by the ligaments which connect this the other bones of the *tarſus*.———A weakſs of theſe ligaments cauſes ſometimes an natural turn of the fore-part of the foot wards.

The *os naviculare* is wholely cartilaginous in new-born infant.

OS CUBOIDES * is a very irregular be.———Behind, it is formed into an oblong equal concavity, adapted to the fore-part the *os calcis*.———On its internal ſide, there a ſmall ſemicircular ſmooth cavity, to join e *os naviculare*.—Immediately before which, oblong ſmooth plane is made by the *os cuiforme externum*.——Below this the bone is llow and rough.——On the internal ſide of e lower ſurface, a round protuberance and *ſa* are found, where the *muſculus adductor llicis* has its origin. On the external ſide of is ſame ſurface, there is a round knob, coverd with cartilage; immediately before which, ſmooth *foſſa* may be obſerved, in which the ndon of the *peronæus primus* runs obliquely oſs the foot; and on the knob, the thin flat cartilage proper to this muſcle plays; in pl of which ſometimes a bone is found:—M externally than the knob, a rough hollow made, for the ſtrong ligaments ſtretched twixt this bone and the *os calcis.*——Bef the ſurface of the *os cuboides* is flat, ſmoo and ſlightly divided into two planes, for ſuſt ing the *os metatarſi* of the little toe, and of toe next to it.

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* Πολυμορφον, cubiforme, quadratum, grandinoſum, varium, rae, multiforme.

The form of the back-part of the *os cuboi* and the ligaments connecting the joint th with the *os calcis*, both concur in allowing li motion in this part.

The oſſification of this bone is ſcarcely gun at the birth.

Os cuneiforme externum *, if we regard ſituation or *medium* by its bulk, is much of ſhape of a wedge, being broad and flat ab with long ſides running obliquely downwa and terminating in a ſharp edge.———The per ſurface of this bone is an oblong ſqu ——The one behind is nearly a triangle, not compleat at the inferior angle, and is j ed to the *os naviculare.*——The external ſid an oblong ſquare divided as it were by a gonal; the upper half of it is ſmooth, for conjunction with the *os cuboides*: The ot is a ſcabrous hollow, and in its ſuperior ante angle a ſmall ſmooth impreſſion is made by *os metatarſi* of the toe next to the little one The internal ſide of this bone is alſo quadr gular, with the fore-part of its edge made and ſmooth by the *os metatarſi* of the toe n

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[*] Chalcoideum externum.

the great one, and the back-part is alſo flat d ſmooth where the *os cuneiforme medium* is tiguous to it.——The fore-part of this bone n oblong triangle, for ſuſtaining the *os meta-* *ſi* of the middle toe.

Os cuneiforme medium, or *minimum*, is ſtill re exactly the ſhape of a wedge than the mer.——Its upper part is ſquare;——its in- nal ſide has a flat ſmooth ſurface above and ind, for its conjunction with the following e; with a ſmall rough *foſſa* below; and a ſiderable ſhare of it is rough and hollow.— e external ſide is ſmooth and a little hollow- , where it is contiguous to the laſt deſcribed e.——Behind, this bone is triangular, where s articulated with the *os naviculare*; and it alſo triangular at its fore-part, where it is tiguous to the *os metatarſi* of the toe next the great one.

Os cuneiforme maximum or *internum*, differs m the two former in its ſituation, which is re oblique than theirs.——Beſides, its broad ck part is placed below, and the ſmall thin int is above and outwards; while its under ad ſurface is concave, for allowing a ſafe ſage to the flexors of the great toe.——The face of this *os cuneiforme* behind, where it is ned to the *os naviculare*, is hollow, ſmooth, d of a circular figure below, but pointed a- ve.—The external ſide conſiſts of two ſmooth d flat ſurfaces, whoſe direction is nearly at ht angles with each other. With the poſte- r, that runs obliquely from below forewards d upwards, the *os cuneiforme minimum* is join- ; and with the anterior, whoſe direction is longitudinal, the *os metatarſi* of the toe n to the great one is connected.———The fo part of this bone is ſemilunar, but flat ſmooth, for ſuſtaining the *os metatarſi* of great toe.———The internal ſide is ſcabro with two remarkable tubercles below, fr which the *muſculus abductor pollicis* riſes, the *tibialis anticus* is inſerted into its up part.

The three cuneiform bones are all ſo ſe red by ligaments, that very little motion is lowed in any of them, and they are cartila nous in a *fœtus* of nine months.

Theſe ſeven bones of the *tarſus*, when jo ed, are convex above, and leave a concavity low, for lodging ſafely the ſeveral muſcles, t dons, veſſels, and nerves that lie in the ſole the foot.—In the recent ſubject, their upper lower ſurfaces are covered with ſtrong li ments which adhere firmly to them, and all bones are ſo tightly connected by theſe and other ligaments, which are fixed to the rou ridges and *foſſæ* mentioned in the preceedi deſcription of the particular bones, that, n withſtanding the many ſurfaces covered w cartilage, ſome of which are of the form the very moveable articulations, no more m tion is here allowed, than only to prevent great a ſhock of the fabric of the body in wa ing, leaping, *&c.* by falling on too ſolid a ba which, if it was one continued bone, would li wiſe be much more liable to be broken: and order to make our foot accommodate itſelf the ſurfaces we tread on, by becoming more leſs hollow, or by raiſing or depreſſing eith ſide of it, as might be judged by what was ſaid of the particular bones.

Sprains here occaſion, as in the wriſt, great pain and obſtinate tumours, which too often cauſe carious bones.

METATARSUS[*] is compoſed of five bones, which, in their general characters, agree with the metacarpal bones; but may be diſtinguiſhed from them by the following marks: 1. They are longer, thicker, and ſtronger. 2. Their anterior round ends are not ſo broad, and are leſs in proportion to their baſes. 3. Their bodies are ſharper above and flatter on the ſides, with their inferior ridge inclined more to the outſide. 4. The tubercles at the lower parts of the round head are larger.

The firſt or internal metatarſal bone is eaſily diſtinguiſhed from the reſt by its thickneſs. —The one next to it is the longeſt, and with its ſharp edge almoſt perpendicular.——The others are ſhorter and more oblique, as their ſituation is more external. Which general remarks, with the deſcription I am now to give of each, may teach us to diſtinguiſh them from each other.

Os metatarſi pollicis is by far the thickeſt and ſtrongeſt, as having much the greateſt weight to ſuſtain. Its baſe is oblong, irregularly concave, and of a ſemilunar figure, to be adapted to the *os cuneiforme maximum.*——The inferior edge of this baſe is a little prominent and

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[*] Στῆθος, πεδίον, planta, planum, veſtigium, ſolium, pectus, præcordium, pectuſculum.

rough, where the tendon of the *peronæus primus* muſcle is inſerted.——On its outſide an oblique circular depreſſion is made by the ſecond metatarſal bone.———Its round head has generally on its fore-part a middle ridge, and two oblong cavities, for the *oſſa ſeſamoidea*; and on the external ſide a depreſſion is made by the following bone.

Os metatarſi of the ſecond toe, is the longeſt of the five, with a triangular baſe ſupported by the *os cuneiforme medium* and the external ſide produced into a proceſs; the end of which is an oblique ſmooth plane, joined to the *os cuneiforme externum*————Near the internal edge of the baſe, this bone has two ſmall depreſſions, made by the *os cuneiforme maximum*, between which is a rough cavity. —Farther forewards we may obſerve a ſmooth protuberance, which is joined to the foregoing bone.———On the outſide of the baſe are two oblong ſmooth ſurfaces, for its articulation with the following bone; the ſuperior ſmooth ſurface being extended longitudinally, and the inferior perpendicularly; between which there is a rough *foſſa*.

Os metatarſi of the middle toe, is the ſecond in length.———Its baſe, ſupported by the *os cuneiforme externum*, is triangular, but ſlanting outwards, where it ends in a ſharp-pointed little proceſs; and the angle below is not compleated.

The internal ſide of this baſe is adapted to the preceeding bone; and the external ſide has alſo two ſmooth ſurfaces covered with cartilage, but of a different figure; for the upper one is concave, and, being round behind, turns ſmaller as it advances forewards; and the lower ſurface is little, ſmooth, convex, and very near the edge of the baſe.

Os metatarſi of the fourth toe, is near as long as the former, with a triangular ſlanting baſe joined to the *os cuboides*, and made round at its external angle, having one hollow ſmooth ſurface on the outſide, where it is preſſed upon by the following bone, and two on the internal ſide, correſponding to the former bone; behind which is a long narrow ſurface impreſſed by the *os cuneiforme externum*.

Os metatarſi of the little toe, is the ſhorteſt, ſituated with its two flat ſides above and below, and with the ridges laterally.——The baſe of it, part of which reſts on the *os cuboides*, is very large, tuberous, and produced into a long-pointed proceſs externally, where part of the *abductor minimi digiti* is fixed; and into its upper part the *peronæus ſecundus* is inſerted.——Its inſide has a flat conoidal ſurface, where it is contiguous to the preceeding bone.

When we ſtand, the fore-ends of theſe metatarſal bones, and the *os calcis*, are our only ſupporters; and therefore it is neceſſary they ſhould be ſtrong, and ſhould have a confined motion.

The bones of the *TOES* are much a-kin to thoſe of the thumb and fingers; particularly the two of the great toe are preciſely formed as the two laſt of the thumb; only their poſition, in reſpect of the other toes, is not oblique; and they are proportionally much ſtronger, becauſe they are ſubjected to a greater force; for they ſuſtain the force with which our bodies are puſhed forewards by the foot behind at every ſtep we make; and on them principally the weight of the body is ſupported, when we are raiſed on our tiptoes.

The three bones in each of the other four toes, compared to thoſe of the fingers, differ from them in theſe particulars.——They are leſs, and ſmaller in proportion to their lengths: — —Their baſes are much larger than their anterior ends: Their bodies are more narrow above and below, and flatter on the ſides —— The firſt *phalanx* is proportionally much longer than the bones of the ſecond and third, which are very ſhort.

Of the four, the toe next to the great one, has the largeſt bones in all dimenſions, and more externally the toes are leſs.——The little toe, and frequently that next to it, have the ſecond and third bones intimately united into one; which may be owing to their little motion, and the great preſſure they are ſubjected to.

The toes are of good uſe to us in walking; for, when the ſole is raiſed, they bring our body, with its center of gravity, perpendicular to the advanced foot.

The bones of the *metatarſus* and toes, are in the ſame condition in children as thoſe of the *metacarpus* and fingers.

The only bones now remaining to complete the deſcription of the ſkeleton, are the ſmall ones, which are found at the joints of the fingers and toes, and in ſome other parts, called

OSSA SESAMOIDEA, which are of very
fferent figures and ſizes, though they are ge-
rally ſaid to reſemble the ſeed of the *ſeſa-*
m.——They ſeem to me nothing elſe than
e ligaments of the articulations or the firm
ndons of ſtrong muſcles, or both, become
ny, by the compreſſion which they ſuffer.
hus the *ſeſamoid* bones at the beginning of the
ſtrocnemii muſcles, are evidently compoſed
the tendinous fibres only.——Theſe, at the
ſt joint of the great toe, are as plainly the
me continued ſubſtance with the ligaments
d the tendons of the *adductor*, *flexor*, *brevis*,
d *abductor*.——That which is ſometimes
ible at the ſecond joint of that toe, is part
the capſular ligament; and if we enume-
e the other *ſeſamoid* bones that are at any
e found, we may obſerve all of them form-
in this manner.——Their number, figure,
ation, and magnitude, are ſo uncertain,
t it were in vain to inſiſt on the differences
each; and therefore I ſhall only in general
mark,

1. That where ever the tendons and liga-
nts are firmeſt, the actions of the muſcles
ongeſt, and the compreſſion greateſt, there
h bones are moſt commonly found.

2. That, *cæteris paribus*, the older the ſub-
t is in which they are ſought, their number
greater, and their ſize is larger.

3. The more labour any perſon is inured to,
has, *cæteris paribus*, the moſt numerous and
geſt *oſſa ſeſamoidea*.

However, as the two at the firſt joint of the
at toe are much larger than any other, are

early formed, and are ſeldom wanting in adult, we may judge, that beſides the m forcible cauſe of their formation, there ſho alſo be ſome particular advantage neceſſary this place, rather than elſewhere, which m poſſibly be, to allow the *flexor* muſcles to ſ their tendons along this joint, ſecure fr compreſſion in the hollow between the two long ſeſamoid bones; while, by removing th tendons from the center of motion, and ving them the advantage of an angle at th inſertion, the force of the muſcles is increa and therefore the great ſuperincumbent wei of our body in progreſſion is more e raiſed.

APPE

APPENDIX.

Of the Marks of a FEMALE SKELETON.

TO finiſh the deſcription of the bones, is generally to conclude the *oſteology*; but that no part of the ſubject may be left untouched, I think it neceſſary to ſubjoin the diſtinguiſhing marks of the male and female ſkeletons; and have choſen to illuſtrate them principally in the latter; becauſe women having a more delicate conſtitution, and affording lodging and nouriſhment to their tender *fœtuſes*, till they have ſufficient ſtrength and firmneſs to bear the injuries of the atmoſphere, and contact of other more ſolid ſubſtances, their bones are frequently incomplete, and always of a make in ſome parts of the body different from thoſe of the robuſt male; which agree to the deſcription already given, unleſs where the proper ſpecialities of the female were particularly remarked; which could not be done in all places where they occur, without perplexing the order of this treatiſe: Therefore I choſe rather to ſum them up here by way of *appendix*.

The cauſes of the following ſpecialities of the female bones may be reduced to theſe three: 1. A weak lax conſtitution. 2. A ſedentary unactive life, increaſing that conſtitution. 3. A proper frame for being mothers.

The bones of women are ſmaller in proportion to their length than thoſe of men; becauſe the force of their muſcles is not ſo great, nor is ſuch ſtrong external force applied to them to prevent their ſtretching out in length.

The depreſſions, ridges, ſcabrous ſurfaces, and other inequalities made by the muſcles, are not ſo conſpicuous in them; becauſe their muſcles are neither ſo thick nor ſtrong, nor ſo much employed, to make ſo ſtrong prints on their bones.

Their *os frontis* is more frequently divided by a continuation of the *ſagittal* ſuture, which depends on the firſt and ſecond general cauſes aſſigned above, for the ſpecialities in their bones; as will appear after reflecting on the account given formerly of the middle internal ſpine of this bone.

Their *clavicles* are leſs crooked; becauſe their arms have been leſs forcibly pulled forwards, which in our *European* women, eſpecially thoſe of diſtinction, is more hindered by their garb.

Their *ſternum* is more raiſed by long cartilages below, that the *thorax* might be there widened in ſome proportion to what it is ſhortened by the preſſure upon the *diaphragm*, when they are with child.

The defect of bone, or the hole in the middle of the *ſternum*, is ofteneſt found in

them

m, to allow the paſſage of the mammary
ſels, ſay ſome: but, in my opinion, this
owing to a lax conſtitution, by which the
fication is not ſo ſoon compleated as in men,
ere the action of the ſolids is vigorous, and
circulation of the fluids is briſk; for a
ch ſmaller hole might have ſerved this pur-
e; and the branches of the internal mam-
ry veſſels which are ſent to the external
s of the *thorax*, do not paſs here, but be-
en the cartilages of the ribs, before theſe
joined to the *ſternum*.

he *cartilago xiphoides*, is oftener bifurcated
omen than men, for the reaſon aſſigned
he preceeding paragraph, *viz.* a leſs forcible
er of oſſification.

he ſuperior cartilages of the ribs ſooner oſ-
, to ſupport the weight of the *mammæ*.

he middle cartilages are more flat and
d by the weight of the breaſts.

he inferior cartilages are longer, for en-
ing the cheſt.

eak women who have born many child-
when young, often have the *vertebræ* of
back bended forewards, and their *ſter-*
depreſſed, or become round ſhouldered and
breaſted (*a*) by the preſſure and weight of
mpregnated *uterus*, and by the ſtrong ac-
of the abdominal muſcles.

he *os ſacrum* is broader and turned much
backwards, for enlarging the *pelvis*.

he *os coccygis* is more moveable, and much
ended forewards, to facilitate the birth.

The

Cheſelden, Anatomy, book 1. chap. 3.

The *oſſa ilium* are more hollow, and reflected outwards, and conſequently furth moved from each other, in order to wide lower part of their *abdomen*, and for the b ſupport of the impregnated *uterus*.

The ridge on the upper part of the *os* is larger in ſuch women as have born chil being extended by the ſtrong action of the *culi recti abdominis*.

The cartilage between the two *oſſa* eſpecially in women who have born chil is thicker than in men, by which the is more capacious in females.

The conjoined ſurfaces of the *oſſa* and of the *oſſa innominata* and *ſacrum* are the angle under the *ſymphyſis* of the *oſſa* is much larger, and the arches formed b and behind by the *oſſa ilium* and *iſchiu* wider, which, with the ſtreighter *os ſa* and more diſtant *tubera iſchii*, leave a l paſſage for the excluſion of the chil birth.

The great tuberoſity of the *oſſa iſchiu* flatter in women than in men, becauſe more preſſed upon in the ſedentary life females enjoy.

In conſequence of the *pelvis* of wome ing wider, the articulations of their t bones muſt be farther removed from each o and therefore a larger ſpace is left fo procreation and birth of children (*a*); diſtance of the thighs, may be one r why women in running generally ſhuffle

---

(*a*) Albin. De oſſib. § 339.

n one ſide to the other than men, to pre-
e the center of gravity of their bodies
n falling too far to a ſide of the joint
he thigh that ſupports them when the o-
is raiſed, which would endanger their
bling to the ground.

FINIS.

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THE

ANATOMY

OF THE

HUMAN NERVES.

AND

A DESCRIPTION of the HUMAN LACTEAL SAC and DUCT.

The EIGHTH EDITION.

By ALEXANDER MONRO *Senior, M. D.* and *P. A.*

BRITISH MUSEUM

PREFACE

To the Seventh EDITION.

BEING informed that the following Eſſays have been uſeful to the ſtudents in anatomy, I have cauſed them to be reprinted with ſuch amendments as I thought neceſſary.

That offence might not be given, I have treated all the opinions concerning the diſputed phyſiology of the nerves with that deference which the uncertainty of the ſubject required; and have not only concealed the names of the writers whoſe ſentiments were different from mine, but have ſhunned quotations from thoſe whom I approve, leſt the knowledge of the latter ſhould be a key to diſcover the former by.

Deſcriptions of the very minute ramifications of the nerves are obſcure to the young gentlemen for whoſe uſe I write; and therefore I have taken notice only of the larger branches in the deſcription of the particular nerves.

The firſt occaſion of my publiſhing my great Maſter Boerhaave's doctrine concerning the Syſtole and Diaſtole of the heart, was to prevent the imputation I might have lain under of aſſu-

ming it to myſelf, when my worth
Maſter and good friend Mr Cheſelde
inſerted it into his anatomy, as com
municated by me, without mentionin
Boerhaave's name. Having now take
away all grounds of ſuch imputatio
and the doctrine, though ſimple an
beautiful, not appearing ſufficient t
account for the phænomena of the mo
tions of the heart, I have omitted it i
this edition.

The deſcription of the receptaculu
chyli and thoracic duct is more acc
rate, than in the common ſyſtems
anatomy; and on that account is he
republiſhed.

The corrections and additions ma
in this edition of the anatomy of t
bones, and of theſe Eſſays, ſhow, th
I pretend not to Perfection; but I wou
however wiſh, that no more faul
were imputed to me than what are re
ly my own.

TH

THE
ANATOMY
OF THE
HUMAN NERVES.

Of the NERVES in general.

1. THE numerous turns which the *carotid* and *vertebral* arteries make before they paſs through the *dura mater*, heſe arteries having neither ſwelling muſcles nor preſſure of the atmoſphere to aſſiſt he courſe of the blood in them after they nter the ſcull, and their diviſion into innumerable communicating branches in the *pia ater*, and its proceſſes, ſhew, that the liquors uſt move more ſlowly and equally in them han in moſt other parts of the body.

2. By the aſſiſtance of injections and miroſcopes, the very minute branches of theſe eſſels (§ 1.) are diſcovered to go from the *a mater*, into the *cortex*, cineritious, or ſhy coloured part of the *cerebrum*, *cere-*

bellum, and *ſpinal marrow*; whereas we ca only ſee longitudinal veſſels, without numerou ramifications or reticular plexuſes, in the whi medullary ſubſtance of theſe parts.

3. The continuity of the *cortex* with th *medulla* of the *encephalon* and *ſpinal marro* is obſervable with the naked eye, and is mo diſtinctly ſeen with the aſſiſtance of a micr ſcope.

4. In diſſecting the *brain* and *cerebellum*, ſee the ſmall beginnings of the *medulla* pr ceeding from the *cortex*, and can trace its gr dual increaſe by the addition of more ſuch whi ſubſtance coming from the *cortex*.

5. Both theſe ſubſtances (§ 4.) are very ſu culent; for being expoſed to the air to dr they loſe more of their weight than moſt ther parts of the body do.

6. In ſeveral places we can obſerve the *m dulla* to be compoſed of fibres laid at each thers ſides.

7. The medullary ſubſtance is emplo ed in forming the white fibrous cords, whi have now the name of *nerves* appropriat to them. Within the ſcull we ſee the ner to be the medullary ſubſtance continued; a the *ſpinal marrow* is all employed in formi nerves.

8. The common opinion concerning riſe of the nerves, founded on a ſuperfic inſpection of thoſe parts, is, that the ner are propagated from that ſide of the *encep lon*, at which they go out of the ſcull. Bu having been remarked, after a more ſtrict quiry, and preparing the parts by macerati

in water, that the medullary fibres decuſſate or croſs each other in ſome parts of the *medulla*; as for example, at the *corpus annulare*, and beginning of the *ſpinal marrow*: And practical obſervators having related ſeveral examples of people whoſe brain was hurt on one ſide, while the morbid ſymptom, palſy, appeared on the other ſide of the body, of which I have ſeen ſome inſtances; and experiments made on brutes having confirmed theſe obſervations, it has been thought, that the nerves had their riſe from that ſide of the *encephalon*, which is oppoſite to their egreſs from the ſcull. It may however ſtill be ſaid, that this laſt opinion is not fully demonſtrated, becauſe a decuſſation in ſome parts is not a proof that it obtains univerſally; and if there are examples of palſy of the ſide oppoſite to where the leſion of the brain was, there are alſo others, where the injury done to the brain and the palſy were both on the ſame ſide.

9. The nerves are compoſed of a great many threads lying parallel to each other, or nearly ſo, at their exit from the *medulla*.

This fibrous texture is evident at the origin of moſt of the nerves within the ſcull; and in the *cauda equina* of the *ſpinal marrow*, we can divide them into ſuch ſmall threads, that a very good eye can ſcarce perceive them; but theſe threads, when looked at with a microſcope, appear each to be compoſed of a great number of ſmaller threads.

10. How ſmall one of theſe fibrils of the nerves is, we know not; but when we conſi-

der that every, even the moſt minute part of the body is ſenſible, and that this muſt depend on the nerves (which all conjoined, would not make a cord of an inch diameter) being divided into branches or filaments to be diſperſed through all theſe minute parts, we muſt be convinced that the nervous fibrils are very ſmall. From the examination of the *minimum viſibile*, it is demonſtrated, that each fibre in the *retina* of the eye or expanded optic nerve cannot exceed the ſize of the 32,400 part o a hair.

11. the medullary ſubſtance, of which th nervous fibrils are compoſed, is very tender and would not be able to reſiſt ſuch forces a the nerves are expoſed to within the bones nor even the common force of the circulatin fluids, were not the *pia mater* and *tunic arachnoides* continued upon them; the forme giving them firmneſs and ſtrength, and th latter furniſhing a cellular coat to connect th threads of the nerves, to let them lie ſoft an moiſt, and to ſupport the veſſels which go wit them.

It is this cellular ſubſtance that is diſtende when air is forced through a blow pip thruſt into a nerve, and that makes a nerv appear all ſpongy, after being diſtended wit air till it dries; the proper nervous fibri ſhrivelling ſo in drying, that they ſcarce can b obſerved.

13. Theſe coats (§ 11.) would not make th nerves ſtrong enough to bear the ſtretchin and preſſure they are expoſed to in their cour to the different parts of the body; and ther

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fore, where the nerves go out at the holes in the *cranium* and *ſpine*, the *dura mater* is generally wrapt cloſely round them, to collect their diſgregated fibres into tight firm cords; and that the tenſion which they may happen to be expoſed to, may not injure them before they have got this additional coat, it is firmly fixed to the ſides of the holes in the bones through which they paſs.

13. The nervous cords thus compoſed of nervous fibrils, cellular coat, *pia* and *dura mater*, have ſuch numerous blood veſſels, that after their arteries only are injected, the whole cord is tinged of the colour of the injected liquor; and if the injection is puſhed violently, the cellular ſubſtance of the nerves is at laſt diſtended with it.

14. A nervous cord, ſuch as has been juſt now deſcribed, (§ 13), has very little elaſticity, compared with ſeveral other parts of the body. When cut out of the body, it does not become obſervably ſhorter, while the blood veſſels contract three eighths of their length.

15. Nerves are generally lodged in a cellular or fatty ſubſtance, and have their courſe in the interſtices of muſcles, and other active organs, where they are guarded from preſſure; but in ſeveral parts they are ſo placed, as if it was intended that they ſhould there ſuffer the vibrating force of arteries, or the preſſure of the contracting fibres of muſcles.

16. The larger cords of the nerves divide into branches as they go off to the different parts; the branches being ſmaller than the

trunk from which they come, and making generally an acute angle where they ſeparate.

17. In ſeveral places, different nerves unit into one cord, which is commonly larger tha any of the nerves which form it.

18. Several nerves, particularly thoſe whic are diſtributed to the bowels, after ſuch union (§ 17.), ſuddenly form a hard knot conſiderably larger than all the nerves of which it made. Theſe knots were called *corpora olivaria*, and are now generally named *ganglions.*

19. The *ganglions* have thicker coats, mor numerous and larger blood-veſſels than th nerves; ſo that they appear more red an muſcular. On diſſecting the *ganglions*, fibr are ſeen running longitudinally in their axe and other fibres are derived from their ſid in an oblique direction to the longitudin ones.

20. Commonly numerous ſmall nerves, whi conjunctly are not equal to the ſize of t *ganglion*, are ſent out from it, but with a ſtru ture no way different from that of other nerv

21. The nerves ſent to the organs of t ſenſes, loſe there their firm coats, and termina in a pulpy ſubſtance. The *optic nerves* are e panded into the ſoft tender webs, the *retin* The *auditory nerve* has ſcarce the conſiſten of *mucus* in the *veſtibulum*, *cochlea*, and *ſem circular canals* of each ear. The *papilla* the noſe, tongue and ſkin, are very ſoft.

22. The nerves of muſcles can likeways traced till they ſeem to loſe their coats by coming very ſoft; from which, and what we ſerved of the ſenſatory nerves (§ 21.), there

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reaſon to conclude, that the muſcular nerves are alſo pulpy at their terminations, which we cannot indeed proſecute by diſſection.

23. It would ſeem neceſſary that the extremities of the nerves ſhould continue in this ſoft flexible ſtate, (§ 21. 22.), in order to perform their functions right: For, in proportion as parts become rigid and firm by age, or any other cauſe, they loſe of their ſenſibility, and the motions are more difficultly performed.

24. Though the fibres in a nervous cord are firmly connected, and frequently different nerves join into one trunk, or into the ſame *ganglion*; yet the ſenſation of each part of the body is ſo very diſtinct, and we have ſo much the power of moving the muſcles ſeparately, that, if the nerves are principal agents in theſe two functions, which I ſhall endeavour to prove they are, we have reaſon to believe that there is no union, confuſion, or immediate communication of the proper nervous fibrils, but that each fibre remains diſtinct from its origin to its termination.

25. Changes produced any way upon the coats of the nerves, cannot however miſs to affect the nervous fibrils. The cellular ſubſtance may be too full of liquor, or may not ſupply enough; the liquor may not be of a due conſiſtence, or it may be preternaturally obſtructed and collected. The *pia* or *dura mater* may be too tenſe, or too lax; their veſſels may be obſtructed; their proper nerves may be violently irritated, or loſe their power of acting; and a great many other ſuch changes may happen, which will not only occaſion diſorders

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orders in particular nerves, but may be a cauſ of the *ſympathy* ſo frequently obſerved amon the nerves; which is ſo neceſſary to be atten tively regarded in a great many diſeaſes, i order to diſcover their true ſtate and natur that, without this knowledge, very dangerou miſtakes in the practice of phyſic and ſurger may be committed.

26. Many experiments and obſervatio concur in proving, that when nerves are com preſſed, cut, or any other way deſtroyed, th parts ſerved by ſuch nerves, farther from th head or ſpine than where the injuring cau has been applied, have their ſenſations, mo tions, and nouriſhment weakened or lo while no ſuch effects are ſeen in the pa nearer to the origin of thoſe nerves; and ſuch experiments where the cauſe impedi the nerves to exert themſelves could be r moved, and the ſtructure of the nerves not i jured; as for example, when a ligature ma upon a nerve and ſtopping its influence h been taken away, the motion and ſenſation the parts ſoon were reſtored. From which would appear, that the nerves are principal i ſtruments in our ſenſations, motions, a nouriſhment; and that this influence of t nerves is not inherent in them, without t communication between theſe cords and th origin is preſerved.

This concluſion is juſt, notwithſtanding t ſometimes, upon cutting a nerve, the effe above mentioned have been felt for a ſh time; but afterwards the perſon was ſenſi f no numbneſs or immobility; for where-ever his is ſaid to have happened, the cut nerve as only one of ſeveral which were ſent to the ember; the want of whoſe influence was felt o longer, than till the habit was acquired of erforming the functions eaſily by the other erves.

Nor is it of greater weight as an objection, at ſometimes when a ligature is drawn very rd upon a nerve, and then is taken away, e nerve never again recovers its influence pon the parts it is diſtributed to beyond the gature, but is of as little effect as if it had een cut through; which is to ſay, that its xture has been altered beyond recovery. he ſame thing is to be ſeen by tying a thread ght round a tender twig of any vegetable; decays.

27. Experiments and obſervations ſhew too, at when parts of the *encephalon* or *ſpinal mar-* *w* have been irritated, compreſſed, or de- oyed, the parts of the body, whoſe nerves d their origin from ſuch affected parts of the *cephalon* or *ſpinal marrow*, became convul- d, paralytic, inſenſible, or waſted; and in ch caſes where the injuring cauſe could be moved from the origin of the nerves, the orbid ſymptoms obſerved in the parts to hich theſe nerves were diſtributed, went off on the removal of that cauſe. From which is thought reaſonable to conclude, that the rves muſt not only have a communication th their origin, but that the influence they ve upon the parts they are diſtributed to de-

pends on the influence which they derive fro
the *medulla encephali* and *ſpinalis*.

28. Though the *ſpinal marrow* has its ow
veſſels and cineritious ſubſtance which aſſiſts t
form its *medulla;* yet a very large ſhare of th
medullary ſubſtance within the ſpine is derive
from the *encephalon*, whoſe *medulla oblongat*
deſcends from the head, and the influence
the *ſpinal marrow* on its nerves depends in
great meaſure on this *medulla oblongata* of th
head. Hence an injury done to any part
the *ſpinal marrow*, immediately affects all th
parts whoſe nerves have their origin belo
where the injuring cauſe is applied. A lux
tion of a *vertebra* in the loins makes the low
extremities ſoon paralytic; a tranſverſe ſec
on of the *medulla* at the firſt *vertebra* of t
neck, ſoon puts an end to life.

29. If ſuch cauſes produce conſtantly ſu
effects (§ 26. 27. 28.) in us and other cr
tures living in nearly the ſame circumſtan
as we do, the concluſions already made m
be good, notwithſtanding examples of childr
and other creatures being born without *bra*
or *ſpinal marrow*; or notwithſtanding that t
brains of adult creatures can be much chang
in their texture by diſeaſes; and that *t*
toiſes, and ſome other animals, continue
move a conſiderable time after their hea
are cut off. We may be ignorant of the p
ticular circumſtances requiſite or neceſſary
the being or well-being of this or that p
ticular creature, and we may be unable to
count for a great many *phænomena*; but
muſt believe our eyes in the examination

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facts; and if we ſee conſtantly ſuch conſequences from ſuch actions, we cannot but conclude the one to be the cauſe and the other the effect. It would be as unjuſt to deny the concluſions made in the three preceeding articles, becauſe of the ſeemingly preternatural phænomena mentioned at the beginning of this, as it would be to deny the neceſſity of the circulation of the blood in us and moſt quadrupeds, becauſe a frog can jump about, or a tortoiſe can walk long after all the bowels of its thorax and abdomen are taken out, or becauſe the different parts of a worm crawl after it has been cut into a great many pieces. It is therefore almoſt univerſally allowed that the nerves are *principal* inſtruments in our ſenſations, motion, and nouriſhment; and that the influence which they have is communicated from their origin, the *encephalon* and *medulla ſpinalis*. But authors are far from agreeing about the manner in which this influence is communicated, or in what way nerves act to produce theſe effects.

30. Some alledge, that *the nervous fibres are all ſolid cords acting by elaſticity or vibration*; others maintain, that *thoſe fibres are ſmall pipes conveying liquors, by means of which their effects are produced.*

31. The gentlemen, who think the nervous fibres ſolid, raiſe ſeveral objections to the other doctrine; which I ſhall conſider afterwards; and endeavour to ſhew the fitneſs of their own doctrine to account for the effects commonly obſerved to be produced by the nerves.

The objects of the ſenſes plainly (ſay the
make impulſes on the nerves of the prop
organs, which muſt ſhake the nervous fibril
and this vibration muſt be propagated alo
the whole cord to its other extremity or or
gin, as happens in other tenſe ſtrings; a
theſe vibrations being differently modified, a
cording to the difference of the object, a
its different application, produce the differe
ideas we have of objects.

32. To this account of ſenſation, it is o
jected, *firſt*, That nerves are unfit for vibr
tions, becauſe their extremities, where obje
are applied to them, are quite ſoft and pap
(§ 21.), and therefore not ſuſceptible of the
brations ſuppoſed; and if there could be any l
tle tremor made here by the impulſe of o
jects, it could not be continued along the nervo
cord, becauſe the cellular ſubſtance by whi
each particular fibre is connected to the neig
bouring ones (§ 11.), and the fatty ſubſtance
which the nervous cord is immerſed (§ 15
would ſoon ſtifle any ſuch vibratory motion.

A *ſecond* objection to this doctrine is, That ſu
poſing the nerves capable of vibrations by t
impreſſions of objects, theſe vibrations wou
not anſwer the deſign. For if what we kno
of other vibrating ſtrings, to wit, that th
tone remains the ſame, unleſs their textu
length, or tenſion is altered, and that differe
ſubſtances ſtriking them do no more th
make the ſound higher or lower; if theſe p
perties are to be applied to nerves, then it w
follow, that the ſame nerve would conſtan
convey the ſame idea, with no other vari

han of its being weaker and ſtronger, whatever
ifferent objects were applied to it ; unleſs we
uppoſed the nerve changed in its texture,
ength, or tenſion, each time a different ob-
ect is applied; which, it is preſumed, no body
ill undertake to prove does happen.

Nay, 3*d'y*, If ever ſuch a variety of vibra-
ions could be made, our ſenſations would not-
ithſtanding be confuſed and indiſtinct, becauſe
he tremulous nervous fibre being firmly con-
ected and contiguous to ſeveral other fibres
f the ſame cord, would neceſſarily ſhake them
o, by which we ſhould have the notion of the
bject as applied at all the different parts where
he extremities of theſe fibres terminate.

33. In whatever way the favourers of the
ctrine of ſolid nerves pleaſe to apply the e-
ſticity of nerves to the contraction of muſ-
es, their adverſaries inſiſt that nerves are
o weak to reſiſt ſuch weights as the muſcles
ſtain; they would ſurely break, eſpecially as
ey are in a great meaſure, if not wholely, de-
ived of their ſtrong coats before they come
the part of the muſcle they are immediately
act upon (§ 22.)—The nerves being found to
ve little or no elaſticity to ſhorten themſelves
14.), ſhews them altogether unfit for ſuch an
fice as this of contracting muſcles in the way
opoſed of their acting by elaſticity; and
hen a nerve is viewed with a microſcope
hile the muſcles it ſerves are in action, no
ntraction or motion is obſerved in it.———
ay, if they were elaſtic, they would equally
ert their power of contracting muſcles near-
to their origin as well as farther from it,

when

when they were put into contraction or vibration, by irritation of any part of them. Th former however does not happen

34. As a further objection againſt either motion or ſenſation being owing to the elaſticit of the nerves, it is ſaid, that if this doctrin was true, the ſenſations would be more acut and the contractions of muſcles would be grea er and ſtronger, when the parts become firm and more rigid by age; for then their elaſticity is increaſed: Whereas, on the contrary, appears (§ 23.). that then the ſenſations a blunted, and muſcular contraction becom leſs and weaker.

35. If the nerves were granted to be elaſti and to communicate a ſpringy force to all t parts they are diſtributed to, they might a pear neceſſary in this view to aſſiſt the applic tion of the nutritious particles of the fluids the ſides of the veſſels which theſe partic were to repair; and ſo far might well enou account for the ſhare which nerves are thoug to have in nutrition: But if we cannot ma uſe of elaſticity in the other two functio ſenſation and motion, we muſt alſo endeavo to find out ſome other way for the nerves act in nutrition; which will be done aft wards.

36. Having thus ſtated the reaſons for againſt the nerves acting as ſolid ſtrings, us likewiſe relate the arguments for ner being pipes, and the objections to this d trine.

A great argument of thoſe who think nerves to be tubes conveying liquors, is

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ſtrong analogy of the brain and nerves to other glands of the body and their excretories, where a manifeſt ſecretion of liquor is made in the glands, to be conveyed by the excretories to the proper places in which it ought to be depoſited: They think that the vaſcular texture of the *cortex* of the *encephalon* and *ſpinal marrow* (§ 2.), the continuation of the *cortex* in forming the medullary ſubſtance (§ 3. 4.), the fibrous texture (§ 6.), and ſucculent ſtate of this *medulla* (§ 5.), and its being wholly employed to form the nerves (§ 7.), where the fibrous texture is evident (§ 9.); all theſe things, ſay they, conſpire to ſhew ſuch a ſtrong analogy between theſe parts and the other glands of the body, as carries a conviction that there is a liquor ſecreted in the *encephalon* and *ſpinal marrow*, to be ſent out by the nerves to the different parts of the body.

37. The following objections are raiſed to this argument in favour of liquor conveyed in the nerves from the analogy of the glands. 1*ſt*, Other glands, it is ſaid, have their excretories collected into a few large pipes, and not continued in ſuch a great number of ſeparate pipes, as far as the places where the liquors are depoſited; which laſt muſt be the caſe, if the nerves are the excretories of the glandular brain. 2*dly*, We ſee the cavities, and can examine the liquors in the excretories of other glands much ſmaller than the brain; which cannot be done in the nerves. 3*dly*, If the nerves were pipes, they would be ſo ſmall, that the attraction of the liquors to their ſides, would prevent that celerity in the motion

tion of the liquors, which is requiſite to ſenſations and motions. *4thly*, If the nerves were pipes, they would be cylindrical ones, and conſequently not ſubject to diſeaſes ; or at leaſ we could have no comprehenſion of the diſeaſes in them.

38. The anſwer to the *1ſt* of theſe objections is, That there are other glands where there is a manifeſt ſecretion, and in which the diſpoſition of the excretories is in much the ſame way as in the *encephalon*: The kidneys for example, have a reticulated *cortex* of veſſels, from which the *Euſtachian* or *Bellinian medulla*, conſiſting of longitudinal fibres and a fe blood veſſels in the ſame direction, proceeds and this *medulla* is collected into ten, twelve, o more *papillæ*, each of which is formed of numerous ſmall ſeparate pipes, which ſingly diſcharge the urine into the large membranou tubes ; and theſe united form the *pelvis*. Upo comparing this texture of the kidneys wit that of the *encephalon* (§ 2. 3. 4. 5. 6. 7. 9.) th analogy will be found very ſtrong.

39. In anſwer to the *2d* objection, in § 3 it is granted, that microſcopes, injections, an all the other arts hitherto employed, have n ſhewn the cavities of the nervous fibrils, the liquors contained in them ; and from wh was ſaid (§ 10.) of the ſmallneſs of the nervous fibrils, it is not to be expected that ev they ſhould be ſeen. But ſo long as ſuch number of little animals can every hour brought to the objectors, in which they can little demonſtrate the veſſels or contain fluids, it will not be allowed to be concluſi

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reaſoning, that becauſe ocular demonſtration cannot be given of either the tubes or their contents, therefore they do not exiſt. For if we have any notion of an animal, it is its being an hydraulic machine, which has liquors moving in it as long as it has life; if therefore ſuch little animals have veſſels and liquors which we cannot ſee, why may not ſome of the veſſels and liquors of the human body be alſo inviſible to us?

To avoid this anſwer to the objection, it is further urged, That though we might not ſee the nervous tubes or the liquors they contain, as they naturally flow; yet if ſuch liquors really exiſt, they ought to diſcover themſelves, either by a nerve's ſwelling when it is firmly tied; or that, however ſubtile their fluids are, they might be collected in ſome drops, at leaſt, when the cut end of a nerve of a living animal is kept ſome time in the exhauſted receiver of an air-pump. It is affirmed, that neither did the tied nerve ſwell between the brain and ligature, nor was there any liquor collected in the receiver of the air-pump; from which it is concluded, that there is no liquor in the nerves.

Some, who ſay they have tried theſe experiments, affirm, that in young animals the nerve does ſwell above the ligature, and that a liquor does drill out upon cutting a nerve. ——— Whether ſwelling or liquor is ſeen or is not ſeen in theſe experiments, no concluſion for or againſt a nervous fluid can be made from them; for the ſwelling of the

nerve

nerve after it is tied, or the efflux of liquor from its extremity, will never prove either t be the effect of the fluid in the proper ner vous fibrils, ſo long as they might be occaſion ed by the liquors in the larger veſſels of th cellular ſubſtance of the nerves; and if theſ ſame veſſels of the coats of the nerves d not diſcover their liquors by theſe experi ments, it is far leſs to be expected, that th much more ſubtile nerves will diſcover theirs.

40. The 3*d* Objection to the doctrine of th brain being a gland, and the nerves its ex cretories, ſuppoſes a more rapid motion neceſ ſary in the fluid of the nerves, than what mo of the defenders of the nervous fluid will no allow; and is afterwards to be conſidered pa ticularly in a more proper place.

41. The 4*th* Objection being, That if nerv are excretories of a gland, they muſt be cy lindrical pipes, in which no obſtructions o diſeaſes would happen; but ſince we dai ſee diſeaſes in the nerves, they muſt ther fore not be ſuch excretories. The anſw is, That diſeaſes happen often in the excr tories of other glands, as of the liver, ki neys, *&c.* notwithſtanding their cylindric form, and their much ſhorter and leſs exp ſed courſe. When we conſider the very tend ſubſtance of the brain, the vaſt complicatio of veſſels there, the prodigious ſmallneſs o the pipes going out from it, the many mo ving powers which the nerves are to underg the ſhock of, and the many chances whic the veſſels, membranes, and cellular ſubſtanc accompanying the nerves have of being di

ordered, and then affecting the nervous fibrils, we have very great reaſon to be ſurpriſed, that theſe cylindrical pipes are not much more frequently put out of order, by too great or too ſmall a quantity of liquors; by too viſcid or too thin fluids; by liquors conſiſting of too mild and ſluggiſh particles, or of too acrid pungent ones; by too great or too little motion given to the liquors; by the diameters of the pipes being too much ſtraitened, or too much inlarged; and by a great many other varieties of circumſtances which might be thought capable of diſturbing the functions of the nerves, ſuppoſing them to be cylindrical excretories of the gland, the brain.

42. The numerous veſſels of the *encephalon* have brought ſome of the gentlemen who aſſert the nerves to be ſolid, to acknowledge, that there is a liquor ſecreted in the brain: But then they will not allow that this liquor is ſent out by the proper nervous fibrils; but that it is poured into the cellular ſubſtance in which the nerves lie, to keep them moiſt and ſupple, and therefore fit for exerting their elaſticity, vibration, *&c.* by which, in their opinion, the effects commonly aſcribed to nerves are produced.

43. Beſides the objections already mentioned (§ 32. 33.) againſt the nerves acting as elaſtic ſtrings, this opinion has ſome other difficulties which may be objected to it: For inſtance, there is not one analogous example in the whole body of liquors ſecreted in a large

gland, to be poured into a cellular ſubſtance
as is here ſuppoſed; the liquors in the cells o
the *tela cellularis* of other parts are ſeparate
from the little arteries which are diſtributed t
theſe cells.

Further, it cannot be imagined, how a l
quor ſecreted in the *cortex* of the brain ſhoul
make its way through the *medulla*, to com
out into the cellular membranes on the ſurfac
of that *medulla*.

Laſtly, A very ſimple experiment, of injec
ing water by the artery of any membe
and thereby filling the cellular ſubſtance of th
nerves of that member, ſhews evidently, th
the liquor of the *cellular* ſubſtance of th
nerves has the ſame fountain as the liqu
has in the *tela cellularis* any where elſe, that i
from the little arteries diſperſed upon it.

44. The doctrine of a fluid in the nerve
is not only thus ſupported by the analogy
the brain and nerves to the other glands a
their excretories, but thoſe who maintain th
doctrine mention an experiment which th
think directly proves a fluid in the nerv
It is this: After opening the thorax of a livi
dog, catch hold of and preſs one or both t
phrenic nerves with the fingers, the *diaphrag*
immediately ceaſes to contract; ceaſe to co
preſs the nerves, and the muſcle acts agai
A ſecond time, lay hold of the nerve
nerves ſome way above the *diaphragm*,
motion ſtops. Keep firm the hold of t
nerve, and, with the fingers of the oth

ha

hand ſtrip it down from the fingers which make the compreſſion towards the *diaphragm*, and it again contracts: A repetition of this part of the experiment three or four times, is always attended with the ſame effects; but it then contracts no more, ſtrip as you will, unleſs you remove the preſſure, to take hold of the nerves above the place firſt pinched; when the muſcle may again be made to contract, by ſtripping the nerve down towards it. This experiment I have done with the ſucceſs here mentioned. Let any one try if he can imagine any other reaſonable account of theſe appearances, than that the preſſure by the fingers ſtopped the courſe of a fluid in the nerve; that ſo much of this fluid as remained in the nerve, betwixt the fingers and *diaphragm* was forced into that muſcle by ſtripping, and when it was all preſſed away, the fingers above preventing a ſupply, the muſcle contracted no more till the fingers were removed, and a freſh flow by that means was received from the ſpinal marrow, or from that part of the nerve which had yet not been ſo ſtripped.

It has been objected to the concluſions from this experiment, 1. That the *diaphragm* is ſet in motion by ſtripping the nerve from, as well as towards, this muſcle; and this may be well expected; for a liquor in ſuch ſmall pipes hindered to flow backwards by ligature, pinching fingers, or even the flow of their liquors from the fountain, will regurgitate forewards with velocity, when preſſed backwards. We ſee it happen in the ſtalks of tender ſucculen plants.

2. It is ſaid, that muſcles ceaſe to act whe their veins are tied, as well as when their ar teries or nerves are tied or cut, but that mu cles continue to act when their veins are cut by which it would appear, that the overloadin of the veſſels is an impediment to the action o muſcles, and therefore the ceaſing of the action when their arteries or nerves are tie or cut, may alſo be owing to the liquor in th branches of theſe pipes of muſcles ſtagnatin when it is not propelled by the flow of mo liquor from their trunks, and not to any i fluence or moving power, which now ceaſes be conveyed to them.

It is to be obſerved in making the exper ments juſt now mentioned, that the contracti of the muſcles ceaſes ſooneſt when the nerv and lateſt when the veins are tied.——Th when veins are tied, not only are the veſſe overloaded, but all the cellular ſubſtance the muſcles is filled with coagulated bloo whereas when the arteries and nerves are tie the reverſe is ſeen, the muſcles are lax and leſs bulk. So that in theſe caſes the ceaſin of the contraction of the muſcles ſeems to d pend on very different cauſes, to wit, a d privation of neceſſary liquors in the one, and redundancy of ſuperfluous blood in the oth An elaſtic ſtick may be deprived of its elaſ city by being made either too dry or too wet

45. Some gentlemen, convinced of t reaſonableſs of the ſecretion of a liquor the brain to be ſent out by the nerves, but n comprehendin

comprehending how a fluid could have ſuch a rapid retrograde motion as they imagined was neceſſary for conveying the impreſſions of objects made on the extremities of nerves to the *ſenſorium*, ſuppoſed two ſorts of nerves; one that conveyed a liquor for muſcular motion and nutrition; the other compoſed of ſolid nerves, that were to ſerve for organs of the ſenſes, to convey the vibrations communicated from objects to the *ſenſorium*.

46. To this opinion (§ 45.) the objections againſt the ſenſatory nerves acting by vibration (§ 32.) may be made; and there is ſo little reaſon to ſuſpect any difference in the texture of the different parts of the brain or nerves, that, on the contrary, the ſtructure is every where ſimilar, and branches of the ſame nerve often ſerve both for ſenſation and motion.

How little neceſſity there is for ſuppoſing extremely rapid motions of the nervous fluid, is to be examined ſoon.

47. The hypotheſis of great celerity in the motion of the fluid of the nerves being neceſſary, gave alſo riſe to another diviſion of the nerves, into *arterious* or *effluent*, and *venous* or *refluent*. It was ſaid, that muſcular motion and nutrition depended on the arterious nerves; and that the ſenſations depended on an accelerated motion of the nervous fluid towards the brain, by the impreſſions which the objects of the ſenſes make upon the venous nerves. By this ſuppoſition the abſurdity of rapid fluxes and refluxes in the ſame canal

was prevented, and an advantage was though to be gained by it, of ſaving too great a waſt of the fluid of the nerves, which otherwiſ the *encephalon* and *ſpinal marrow* could not ſupply in ſufficient quantity to anſwer all the exigencies of life.

48. To this opinion (§ 47.) it has been objected, 1*ſt*, That there is no example in th body of a ſecreted liquor being returned immediately and unmixed to the gland by whic it was originally ſeparated from the maſs o blood; which would be the caſe were ther venous nerves. 2*dly*, There is no occaſio for ſaving the fluid of the nerves in the wa propoſed; the organs for ſecreting that flui being large enough to ſupply all that is neceſſary of it in the common functions of life.— 3*dly*, If the fluid of the nerves was to b thus kept in a perpetual circulation, it woul ſoon become too acrid for continuing wit ſafety in ſuch ſenſible tender veſſels as th brain and nerves are compoſed of. 4*thly* This hypotheſis will not anſwer the deſign fo which it was propoſed: For though the momentary application of an object might cauſ an acceleration in the fluid of venous nerves yet if the object was kept applied to th nerves, it would ſtop their fluid, ſo that i could not go foreward to the brain; and therefore, according to this doctrine, we ſhould b ſenſible of no objects except thoſe whoſe application to the organs of the ſenſes was momentary.

49. Let us now ſuppoſe it probable, that th *encephalon* and *ſpinal marrow* ſecern a liquo

from the blood which is ſent into all the nerves, and that by the means of this liquor, the nerves perform the offices commonly aſſigned to them; it is next neceſſary to inquire what kind of liquor this is, and how it moves, in order to determine how well its nature and motion are fitted for performing what is expected from it.

50. The liquor of the nerves has been fancied by ſome to be of a very ſtrong acid or alcaline nature: But ſince none of our juices appear to be of this ſort, and ſince ſuch liquors irritate and deſtroy the parts of the body which they are applied to, we cannot conceive how the brain can ſeparate, or the nerves could bear any thing of ſuch an acrid nature. This tenderneſs and ſenſibility of theſe organs muſt hinder us abſolutely from ſuppoſing that the liquor of the nerves can be acrid or pungent, or of the nature of ſpirit of wine, hartſhorn, &c.

51. Some have imagined the liquor of the nerves to be capable of vaſt exploſion like gun-powder, or of violent ſudden rarefaction like air, or of ſtrong ebullition like boiling water, or the mixture of acids with alcaline liquors. But as the maſs of blood from which this fluid is derived, is not poſſeſſed of any ſuch properties, we cannot ſuppoſe the blood to furniſh what it has not in itſelf. Beſides, all theſe operations are two violent for the brain or nerves to bear; and when once they are begun, they are not ſo quickly controlled or reſtrained, as experience teaches us the nerves can be made to ceaſe from acting.

52. We are not ſufficiently acquainted with the properties of an *æther* or *electrical effluvia* pervading every thing, to apply them juſtly in the animal œconomy; and it is as difficult to conceive how they ſhould be retained or conducted in a long nervous cord. Theſe are difficulties not to be ſurmounted.

53. The ſureſt way of judging what kind of liquor this of the nerves muſt be, is to examine the liquors of ſimilar parts of the body. All the glands ſeparate liquors from the blood much thinner than the compound maſs itſelf; ſuch is the *liquor* poured into the cavity of the *abdomen*, *thorax*, *ventricles of the brain*, the *ſaliva*, *pancreatic juice*, *lymph*, &c. Where-ever there is occaſion for ſecreted liquors being thick and viſcid, in order to anſwer better the uſes they are intended for, nature has provided reſervoirs for them to ſtagnate in, where their thinner parts may be carried off by the numerous abſorbent veins diſperſed on the ſides of thoſe cavities; or they may exhale where they are expoſed to the open air. The *mucus of the noſe* becomes viſcid by ſtagnation; for, when it is immediately ſecreted, it is thin and watery; as appears from the application of ſternutatories, &c. The *cerumen* of the ears is of a watery conſiſtence, when juſt ſqueezing out. The *mucus* of the alimentary canal grows thick in the *lacunæ*. The *bile* in the hepatic duct has little more conſiſtence than lymph; *that* in the gall-bladder is viſcid and ſtrong. The *urine* is much more watery as it flows from the kidneys, than when it is ex-

creted from the bladder. The *ſeed* is thin as it comes from the teſticles, and is concocted in the *veſiculæ ſeminales*, &c.

54. Hence (§ 53) we may ſafely conclude, that a thin liquor is ſecreted in the *cortex encephali* and *ſpinal marrow;* and ſeeing the thinneſs of ſecreted liquors is generally, as the diviſions of the veſſels, into ſmall ſubtile branches, and that the ramifications within the ſcull are almoſt infinitely ſubtile, the liquor ſecreted in the *encephalon* may be determined to be among the fineſt or thinneſt fluids.

55. Seeing alſo that we can obſerve no large reſervoir, where the liquor ſecerned in the *cortical ſubſtance* is depoſited, to have its finer parts taken of, we have reaſon to think, that it goes foreward into the nerves in the ſame condition in which it is ſecerned.

56. By fine or ſubtile animal liquors, is meant no more than thoſe which are very fluid, and which ſeem to conſiſt of a large proportion of watery particles, and a leſſer one of the oily, ſaline, and terreſtrious particles. Some of the liquors which we can have in ſufficient quantity to make experiments with, are ſo fluid, and have ſo little viſcidity or coheſion of parts, that when laid upon a piece of clean mirror, they evaporate without leaving a ſtain; ſuch is the liquor ouſing out from the ſurface of the *pleura*, the lymph, and ſeveral others.

If then theſe liquors, which are ſubject to our examination, the ſecerning veſſels of which are ſo large that we can ſee them, have ſuch a ſmall coheſion of parts, it might not be unreaſonable to ſay, that the liquor of the nerves is as much more fine and fluid than lymph as the veſſels ſeparating it are ſmaller; and therefore that the fluid of the nerves is a defecated water, with a very ſmall proportion of the other principles extremely ſubtilized.

57. Two experiments are ſaid to contradict this opinion of the liquor of the nerves being ſo fluid and ſubtile. One is, that upon cutting the *cauda equina* of a living animal, a liquor as viſcid as the white of an egg drops out: The other is, that a wounded nerve yields a *glairy ſanies*. But theſe don't appear to be the proper fluid of the nerves; ſince it is evident, that what is diſcharged in both theſe caſes, comes out of the cellular ſubſtance involving the nervous fibrils.

58. Conſidering how many experiments make it evident, that there is a conſtant uninterrupted ſtream of liquors flowing through all the canals of animals, which convey liquors compoſed of particles ſmaller than the diameter of their canal, which is always the caſe of the nerves in a natural ſtate; it is ſurprizing how it ever could be thought that the liquid of the nerves ſhould be obliged to flow from the brain to each muſcle the moment we will; or that this liquor ſhould flow back with the like ſwiftneſs from the extremity of each nerve, to which an object of ſenſation is applied. The nerves, as well as the other excretories of the glands, always are full of liquor; the degree of diſtenſion of the canals not being at all times alike even in a

ſound ſtate. But this happens without inconvenience, as the ſides of the canals have a power to accommodate themſelves to the preſent quantity, unleſs it is very much above or below the natural ſtandard; in both which caſes diſeaſes enſue.

59. The motion of the fluid in the nerves is therefore not only conſtant, but it is alſo equal, or nearly ſo: For, though the blood in the larger arteries is moved unequally by the unequal forces, the contraction of the ventricle of the heart, and the weaker power, the *ſyſtole* of the arteries; yet the difference between theſe two moving powers comes to be leſs and leſs perceptible, as the arteries divide into ſmaller branches; becauſe of the numerous reſiſtences which the liquors meet with, and becauſe the canals they move in become larger, till in the very ſmall arterious branches, there is no ſenſible difference in the velocity of the liquors from the effect of the heart or arteries. The motion of the fluids muſt ſtill be more equal in the excretories of glands, and particularly in thoſe where the veſſels have divided into very minute branches, and the liquors have no other propelling force but the heart and arteries, (ſee § 1.); therefore the nervous fluid moves conſtantly, equally, and ſlowly, unleſs when its courſe is altered by the influence of the mind, or by the preſſure of ſome neighbouring active organ.

60. As there is neither proof nor probability of the *valves* ſuppoſed by ſome in nerves, we are not to aſſume them in accounting for any *phænomena*.

61. We have not, and perhaps cannot have any idea of the manner in which mind and body act upon each other; but if we allow that the one is affected by the other, which none deny, and that the fluid of the nerves (whatever name people pleaſe to give it) is a principal inſtrument which the mind makes uſe of to influence the actions of the body, or to inform itſelf of the impreſſions made on the body, we muſt allow that the mind can direct this inſtrument differently, particularly as to quantity and celerity, though we muſt remain ignorant of the manner how many *phænomena* depending on this connection of mind and body are produced. Thus we would in vain attempt to account for animals continuing, after their heads were ſtruct off or their hearts were cut out, to perform actions begun before they ſuffered any injury.

62. Let us now ſuppoſe the nervous fluid ſuch as has been argued for, to wit, a very fluid ſaponaceous water, moving in a conſtant, equal, ſlow ſtream, from the *encephalon* and *ſpinal marrow*, in each of the proper nervous fibres, except when the motion is changed by ſome acceſſory cauſe, ſuch as the mind, preſſure of other parts, *&c.*; and let us examine how well ſuch a ſuppoſition will agree with the *phænomena* of the three great functions, nutrition, ſenſation, and muſcular motion, which the nerves are principal inſtruments of.

63. In general, we may ſay, that nerves can carry fluids to the moſt minute part of the body, to ſupply what is waſted in any of the ſolids; that the impreſſion made by the ob

jec

jects of the ſenſes on the very ſoft pulpy extremities of the nerves of the organs of the ſenſes, muſt make ſuch a ſtop in the equal-flowing nervous fluid, as muſt inſtantaneouſly be perceptible at the fountain-head from which the pipes affected ariſe; that the conſtant flow of the liquor of the nerves into the cavities of the *muſcular fibrillæ*, occaſions the natural contraction of the muſcles, by the as conſtant *niſus* it makes to increaſe the tranſverſe and to ſhorten the longitudinal diameter of each fibre; and that it is only to allow the mind a power of determining a greater quantity of this ſame fluid with a greater velocity into what muſcular fibres it pleaſes, to account for the voluntary ſtrong action of the muſcles.

64. But ſince ſuch a ſuperficial account would not be ſatisfactory, it will be expected, that the principal *phænomena* of theſe three functions ſhould be explained by the means of ſuch a fluid as has been ſuppoſed; and that the ſeveral objections againſt this doctrine ſhould be anſwered: Let us attempt this; and where we cannot extricate ourſelves from difficulties which may be thrown in, let us honeſtly acknowledge ignorance.

65. α. If water, with a very ſmall proportion of oils and ſalts from the earth, proves a fit nouriſhment for vegetables, ſuch a liquor as the fluid of the nerves has been deſcribed (§ 56.) may not be unfit for repairing the waſte in animals.

β. The ſlow continual motion of this nervous fluid (§ 58. 59.) to the moſt minute parts of the body (§ 10.), is well enough calculated to ſupply the particles that are conſtantly worn off from the ſolids by the circulation of th liquors and neceſſary actions of life.

γ. The greater proportional ſize of the *encephalon* in young creatures than in adults ſeems calculated for their greater proportional growth: For the younger the animal is the larger *encephalon* and ſpeedier growth i has.

δ. A palſy and atrophy of the members generally accompanying each other, ſhew, tha nouriſhment, ſenſation, and motion, depend o the ſame cauſe.

ε. It was ſaid (§ 26.), that the nerves wer *principal* inſtruments in nutrition: It was no affirmed, that they were the *ſole* inſtruments and therefore an *atrophy* may proceed from the compreſſion or other leſion of an artery without being an objection to the doctrine her laid down.

66. *a.* All objects of ſenſe, when applied t their proper organs, act by impulſe; and thi action is capable of being increaſed by increaſing the impelling force. In tangible objects, that is clearly evident; the cloſer the are preſſed to a certain degree, the more diſtinct perception enſues. Odorous particle need the aſſiſtance of air moved rapidly, t affect our noſe: Sapid ſubſtances, that ar ſcarce ſufficient to give us an idea of their taſt by their own weight, are aſſiſted by the preſure of the tongue upon the palate: The ray of light collected drive light bodies befor them: Sound communicates a vibration to a bodies in harmonic proportion with it.

The impulſes made thus by any of theſe ob- ſts on the ſoft pulpy nerves (§ 21.), which re full of liquor, preſſes their ſides or extre- ities, and their liquor is hindered to flow ſo eely as it did. The canals being all full (§ 58.) is reſiſtance muſt inſtantaneouſly affect the hole column of fluids in the canals that are reſſed, and their origins, and have the ſame fect as if the impulſe had been made upon e origin itſelf. To illuſtrate this by a groſs mpariſon: Let any one puſh water out of a ringe, through a long flexible pipe fixed to e ſyringe, and he is ſenſible of reſiſtance or puſh backwards, the moment any one ſtops e orifice of the pipe, or cloſes the ſides of with his fingers. This impulſe made on e nerves, and thus communicated to their igin, varies according to the ſtrength or eakneſs, the quickneſs or ſlowneſs, the con- uance or ſpeedy removal, the uniformity irregularity, the conſtancy or alternation, c. with which objects are applied to the rves.

b. Whenever any object is regularly applied ith due force to a nerve, rightly diſpoſed be impreſſed by it, and is communicated, juſt now explained, to the *ſenſorium*, it ves a true and juſt idea of the object to the ind.

c. The various kinds of impulſes which the fferent claſſes of objects make, occaſion in imals, which ought to have accurate percep- ons of each object, a neceſſity of having the fferent organs of the ſenſes variouſly modi- d, ſo that the ſeveral impulſes may be regularly applied to the nerves in each organ ; o in other words, we muſt have different orga of the ſenſes fitted to the different claſſes of o jects.

d. As the objects have one common prop ty of impulſe, ſo all the organs have moſt the properties of the organ of touching in co mon with the *papillae* of the ſkin. In t noſe and tongue, this is evident : In ſome perations of the eyes we can alſo perceive thi as we may likewiſe do in ſome caſes whe matter is collected in the internal ear.

e. Theſe properties common to the differ objects and organs occaſion frequently u common effects in the application of an o ject to an organ proper to another object ſenſation ; for ſometimes we have the ſa idea as if the object had been applied to own proper organ : At other times the o ject is as it were changed, and we have the id as if the organ had had its own proper o ject applied to it. Thus, for example, lig is the proper object to be applied to the ey to give us any idea of colours ; yet when light is excluded from the eyes, an idea light and colours may be excited in us couching, ſneezing, rubbing, or ſtriking t eye-ball.--------- A cane vibrating, ſo as not excite ſound perceptible to the ear, applied the teeth, raiſes a ſtrong idea of ſound ; as little inſect creeping in the *meatus auditori* alſo does.---The fingers applied to two rou ſurfaces, rubbing on each other, are ſenſible the ſound they make ; ſurgeons of any practi the cure of fractured bones can bear wit- ſs to the truth of this.-------The fingers dip- d in acid and ſeveral other acrid liquors, ve a ſenſation very like to taſting.——— nelling and taſting every body knows are bſervient and aſſiſting to each other. From ch examples we have further proof of one neral cauſe of our ſenſations, to wit, impulſe om the objects; and of ſuch a ſimilarity and lation in the organs, as might give reaſon r imagining that any one of them would be pable of producing the effect of another, if e impulſes of the different objects could be gularly applied to each.——Hence light and und may affect inſects and other animals that ve not eyes or ears.

f. If the impulſe of an object is applied with ie force, but irregularly, a confuſed idea of e object is raiſed. Diſtant objects are con- ſed to *myopes*, as very near ones are to *preſ- le.*

g. If the application of the impulſe is re- lar, but the force with which it is applied too weak, our perception of the object is o faint. One may whiſper ſo low as not to heard.

h. If the application of objects is too vio- nt, and there is any danger of the tender gans of our ſenſes being hurt or deſtroyed, uneaſy ſenſation we call *pain* is raiſed, hatever the organ thus injured is. The ob- t of feeling affects every organ: Thus preſ- re, ſtretching, cutting, pricking, acrid ſalts, ngent oils, great heat, violent cold, &c. oc- aſion pain, where ever they are applied.

Beſides, every particular organ can be a
fected with pain by the too violent applic
tion of its own proper object. Too muc
light pains the eyes ; very loud ſound ſtu
the ears ; very odorous bodies and too ſap
objects hurt the noſe and tongue. A pret
ſure proof this, that the objects of our ſen
all act, and that the organs are all impreſſe
in nearly the ſame way.

i. Since a middle impulſe, neither too ſma
nor too great, is neceſſary for a clear perce
tion of objects, we would often be in dang
of not diſtinguiſhing them, if we were not ſu
jected to another law, to wit, that numero
impulſes made at once, or in a quick ſucce
ſion to each other, increaſe our perceptions
objects. Thus, ſuch ſound as would not
heard on a mountain top, will be diſtinct
heard in a wainſcotted chamber.------We fe
much more clearly a tangible object when o
finger is drawn alongſt it than when appli
with the ſame force, but by a ſingle preſſur
upon it.———We make repeated applicatio
of odorous and ſapid objects, when we wiſh
ſmell or taſte accurately.————The end of
burning ſtick appears much more lumino
when quickly whirled in a circle than when
reſt.

k. Whenever the uneaſy ſenſation, *pain,*
raiſed by the too ſtrong application of o
jects, a ſort of neceſſity is as it were impoſ
upon the mind to endeavour to get free
the injuring cauſe, by either withdrawing t
grieved part of the body from it, as o
retires his hand when his finger is pricked

burnt; or the injuring cauſe is endeavoured to be forced from the body, as a *teneſmus* excites the contraction which puſhes acrid *fœces* out of the *rectum*. In both theſe operations, a convulſive contraction is immediately made in the leſed part, or in the neighbourhood of it; and if the irritation is very ſtrong or permanent, the greater part of the nervous ſyſtem becomes affected in that ſpaſmodic or convulſive way.-------Is it this neceſſity which obliges the mind to exert herſelf in reſpiration, or in the action of the heart, when the lungs or heart are gorged with blood? or the *iris* to contract the pupil, when the eye is expoſed to ſtrong light? or ſneezing to be performed when the noſe is tickled? *&c.* ------ Will not a *ſtimulus* of any nerve more readily affect thoſe with which it is any where connected than the other nerves of the body? - - - - - May not this ſympathy ſerve as a monitor of the mind rather to employ the organs furniſhed with nerves thus connected, to aſſiſt in freeing her of any uneaſy ſenſation, than to make uſe of any other organs? - - - Will not this in ſome meaſure account for many ſalutary operations performed in the body before experience has taught us the functions of the organs performing them?

This *niſus* of the mind to free the body of what is in danger of being hurtful, may ſerve to explain the *phænomena* of a great many diſeaſes, when we are acquainted with the diſtribution of the particular nerves; and from this we can underſtand the operation of medicines that ſtimulate; and may learn how, by exciting a ſharp, but momentary pain, we may free the body of another pain that would be more durable; and that, by having it thus in our power to determine a flow of the liquor of the nerves to any particular part, for the benefit of that part, or the relief of any other diſeaſed part, we can do conſiderable ſervice by a right application of the proper medicines.

l. If a pain-giving cauſe is very violent or long continued, it deſtroys the organs either irrecoverably, or puts them ſo much out of order that they only gradually recover: People have been made blind or deaf for all their lives after a violent effect of light on their eyes, or of ſound on their ears; and we are frequently expoſed to as much light and ſound as to make us unfit to ſee or hear for a conſiderable time. I would explain this by a ligature put round the tender branch of an herb. This ligature drawn to a certain degree, may weaken the canals ſo as to be unfit for the circulation of the juices a good while, till they are gradually explicated and made firm by theſe juices: A ſtricter ligature would diſorder the ſtructure of the fibres ſo much, that the liquors could not recover them. The analogy is ſo plain, that it needs no commentary.------- Thus the influence of a nerve tied with an artery in the operation of an aneuriſm may ceaſe for ſome time, but be afterwards recovered.

67. 1. In applying the fluid of the nerves to the action of muſcles, it was ſaid, that

the natural or involuntary contraction of muſcles was the *niſus* which the nervous fluid flowing conſtantly into the muſcular fibres makes to diſtend theſe fibrils, by enlarging their tranſverſe diameters and ſhortening their axes; and that voluntary contraction was owing to a greater quantity of that nervous liquor determined towards the muſcle to be put in action, and poured with greater *momentum* into the muſcular fibrils, by the power of the mind willing to make ſuch a muſcle to act, or obliged to do it by an irritating pain-giving cauſe (§ 66. *k.*)

2. Some object to this account of muſcular motion, that if there is no outlet for the liquor ſuppoſed to be poured into muſcular fibres, muſcles would always be in a ſtate of contraction, which they are not; and if there is a paſſage from the fibrils, the liquor would flow out as faſt as it was thrown in; and therefore no diſtenſion of the fibres or contraction of the muſcles could be made.

3. In anſwer to this objection, it is obſerved, that notwithſtanding the evident outlet from the arteries into the veins, yet the arteries are diſtended by the *ſystole* of the heart, or any other cauſe increaſing the *momentum* of the blood.

4. It has been alſo objected to § 1. that, if it was true, the volume of the muſcle in contraction neceſſarily would be conſiderably increaſed by ſo much liquor poured into its fibrils; whereas it does not appear, by any

experiment,

experiment, that the volume of a muſcle is increaſed by its being put into action.

5. To this it has been anſwered, 1. That when the axes of muſcular fibres are ſhortened, and their tranſverſe diameters are enlarged, the capacities of their fibres, and conſequently their volume, may not be changed, the diminution one way balancing the increaſe in the other. 2. That the ſpaces between the muſcular fibres are ſufficient to lodge theſe fibres when they ſwell, during the contraction of a muſcle, without any addition to its bulk; and that it plainly appears that theſe ſpaces between the fibrils are thus occupied, by the compreſſion which the larger veſſels of muſcles, which run in thoſe ſpaces, ſuffer during the action of the muſcle; it is ſo great as to drive the blood in the veins with a remarkable accelerated velocity.

6. Another objection to the action of muſcles being owing to the influx of a fluid into their fibrils is, That muſcular fibres are diſtractile, or capable of being ſtretched; and therefore, when a fluid is poured into their hollow fibrils, they would be ſtretched longitudinally, as well as have their tranſverſe diameters increaſed; that is, a muſcle would become longer, as well as thicker, when it is put into action; whereas it is certainly known that a muſcle is ſhortened while it acts.

7. In anſwer to this, it has been remarked, That though muſcular fibrils are diſtractile, yet they will not yield to, or be ſtretched by every force, however ſmall, that might be applied to them. A cord that can be ſtretched

ed in length by the weight of a pound or two, would not yield in the leaſt to an ounce or two; and it muſt likeways be obſerved, that gradually as any body is ſtretched, its reſiſtance to the ſtretching force increaſes. A rope may be ſtretched to a certain length by a pound weight appended to it, which would require two pounds to ſtretch it very little further; and therefore the general obſervation of animal fibres being diſtractile, cannot be a reaſonable objection to the account of muſcular motion above mentioned, unleſs a proof is brought that the force which the liquid of the nerves muſt exert upon each fibre of a muſcle, in order to make it act, is capable of diſtracting or ſtretching the fibres; which has not yet been attempted to be proved.——It would appear from the pain cauſed by too great an effort of muſcles, eſpecially in weak people, that muſcular fibres can bear very little diſtraction without danger of a ſolution of continuity.

8. Muſcles ceaſing to act when their arteries are tied or cut, and being brought into motion by injecting liquors into the arteries even of a dead animal, has been mentioned as objections to the nervous influence cauſing their contractions.

To the firſt of theſe experiments it may be anſwered, That the tying or cutting of the nerves ſooner produces the effect of making the contraction ceaſe than ſtopping the influx of the arterious blood does; and it will be univerſally allowed, that the influx of blood into muſcles is neceſſary for performing their functions right.

Whoever obſerves the motion which injecting water or any other liquor into the arteries of a dead animal, cauſes in its muſcles, will not compare it to what contraction, whether voluntary or excited by irritation, he may ſee in a living one.

9. If muſcular motion depends on the influx of the nervous liquid, the inſtantaneous contraction of a muſcle, when the mind wills to make it act, will be eaſily underſtood from the nerves being always full of their liquor (§ 58. 66. *a.*)

10. If either the nerves of any muſcle do not furniſh a ſufficient quantity of their liquor, or if the fibres of a muſcle become too eaſily diſtractile, ſuch a muſcle will be unactive or paralytic.

11. If too great a quantity of the liquor of the nerves is determined to a muſcle or muſcles, by any cauſe which the mind cannot command, ſuch muſcle or muſcles will be convulſed.

12. If the motion of the liquid of the nerves is not uniform, but by diſeaſe becomes irregular, an alternate relaxation and contraction of muſcles may be the conſequence. Hence trembling palſies, *chorea Sancti Viti*, &c. Hence alſo the convulſive tremors which animals have when they loſe much blood.

13. Though the nerves may not furniſh ſo much liquor as may be ſufficient to make muſcles contract with ſtrength enough to overcome

come the reſiſtances to their actions, yet there may be a ſufficient quantity of liquor in the nerves to allow the impreſſions of objects to be conveyed to the *ſenſorium*. This may be one cauſe of a member's being ſometimes ſenſible after it cannot be moved.

14. Unleſs the liquor of the nerves acquires ſome energy in the brain, which we have no reaſon to think the circulation of the fluids in the veſſels can give it, or unleſs it has other properties than what we can diſcover in it, or unleſs there is an agent regulating its *momentum* and courſe to different parts which we are not conſcious of; if ſome of theſe, I ſay, do not obtain, the action of the heart continuing of equal force to propel our liquors, notwithſtanding all the reſiſtances that are to it, is not to be explained.

15. All muſcles, but eſpecially the heart, continue to contract in an irregular way, after they are cut away from the animal to whom they belonged; which may be owing to the liquors continuing to flow in the ſmall veſſels, and being powered irregularly into the muſcular *fibrillæ*.

16. It is ſaid that a muſcle cut out of the body continues ſome time to be capable of contraction; whereas by tying its arteries or nerves, while it is otherviſe entire in the body, it loſes its contracting power, which therefore does not depend on theſe organs, the arteries or nerves.

The loſs of the power of acting when the arteries or nerves are tied while the muſcle is in the body, is denied by ſome who made the trial, and it might be expected that the motion of a muſcle would be more conſpicuous where there is no reſiſtance to it, as is the caſe when it is cut away from all the parts it is connected with, than when its connection remains with parts reſiſting its contractile efforts.

17. After the heart, or any other muſcle cut away from an animal, has ceaſed to contract, its contraction may again be reſtored, by breathing upon it, or pricking it with any ſharp inſtrument. That heat or pricking ſhould, by their *ſtimulus* (§ 66. *k.*) occaſion contraction in a living creature, may be underſtood; but how they ſhould have the ſame effect in a muſcle ſeparated from an animal, I know not.

68. Some have thought the *ganglions* of nerves (§ 18. 19. 20.) to be glandular, and to perform a ſecretion.——Others, from their firm texture, ſuppoſe them to be muſcular, and to ſerve to accelerate the motion of the liquor in the nerves which proceed from them; but as no proof is offered of either of theſe opinions, they cannot be maintained.———Others would make them ſerve, 1. To divide a ſmall nerve into many nerves, and by theſe means to increaſe the number of nervous branches. 2. To make nerves come conveniently by different directions to the parts to which they belong. 3. To reunite ſeveral ſmall nervous fibres into one large nerve.——Since no proof is brought that theſe three things cannot be done without the interpoſition of a *ganglion*, but on the contrary, we ſee them performed where there

are no *ganglions*, we muſt continue to acknowledge ignorance concerning the uſes of theſe knotes, the *ganglions*.

Of the PARTICULAR NERVES.

'TIS generally ſaid, that there are forty pair of nerves in all; of which ten come out from the *encephalon*, and the other thirty have their origin from the *ſpinal marrow*.

Of the ten pair of nerves which come from the *encephalon*, the firſt is the *OLFACTORY*, which long had the name of the *mammillary proceſſes* of the brain, becauſe in the brutes, cows and ſheep, which were moſt commonly diſſected by the antients, the anterior ventricles of the brain are extended forewards upon theſe nerves, and adhere ſo firmly to them, that they ſeem to make the upper ſide of the nerves. Each of them being large, where it begins to be ſtretched out, and gradually becoming ſmaller as it approaches the cribriform bone, was imagined to reſemble a nipple. Thoſe who miſtook the ventricles for part of the nerves, obſerving the cavity in them full of liquor, concluded, that theſe olfactory nerves ſerved to convey the ſuperfluous moiſture of the brain to the holes of the ethmoid bone through which it paſſed into the noſe. But in man, the ventricles of whoſe brain are not thus extended forewards, theſe nerves are ſmall, long, and without any cavity, having their oirgin from the *corpora ſtriata*, near the part where the internal carotid arteries are about to ſend off their branches to the different parts of the brain; and in their courſe under the anterior lobes of the brain, which have each a depreſſion made for lodging them, the human olfactory nerves become larger, till they are extended to the cribriform bone; where they ſplit into a great number of ſmall filaments, to paſs through the little holes in that bone; and being joined by a branch of the fifth pair of nerves, are ſpread on the membrane of the noſe.

The tender ſtructure and ſudden expanſion of theſe nerves on ſuch a large ſurface, render it impoſſible to trace them far; which has made ſome authors deny them to be nerves: But when we break the circumference of the *cribriform lamella*, and then gently raiſe it, we may ſee the diſtribution of the nerves ſome way on the membrane of the noſe.

The contrivance of defending theſe long ſoft nerves from being too much preſſed by the anterior lobes of the brain under which they lie, is ſingular; becauſe they have not only the prominent orbitar proceſſes of the frontal bone to ſupport the brain on each ſide, with the veins going into the longitudinal *ſinus*, and other attachments bearing it up, but there is a groove formed in each lobe of the brain itſelf for them to lodge in.——Their ſplitting into ſo many ſmall branches before they enter the bones of the ſcull, is likewiſe peculiar to them; for generally the nerves come from the brain in diſgregated filaments, aud unite into cords, as they are going out at the holes of the bones. This contrivance is the beſt for anſwering the purpoſe they are deſigned for, of being the organ of ſmelling; for had they been expanded upon the membrane of the noſe into a medullary web, ſuch as the optic nerve forms, it would have been too ſenſible to bear the impreſſions of ſuch objects as are applied to the noſe; and a diſtribution in the more common way, of a cord ſending off branches, would not have been equal enough for ſuch an organ of ſenſation.

The 2*d* pair of nerves, the *OPTIC*, riſing from the *thalami nervorum opticorum*, make a large curve outwards, and then run obliquely inwards and forewards, till they unite at the fore-part of the *ſella turcica*; then ſoon divide, and each runs obliquely forewards and outwards to go out at its proper hole in the ſphenoid bone, accompanied with the ocular artery, to be extended to the globe of the eye, within which each is expanded into a very fine cup-like web, that lines all the inſide of the eye as far forewards as the *ciliary circle*, and is univerſally known by the name of *retina*.

Though the ſubſtance of this pair of nerves ſeems to be blended at the place where they are joined; yet obſervations of people whoſe optic nerves were not joined, and of others who were blind of one eye from a fault in the optic nerve, or in thoſe who had one of their eyes taken out, make it appear, that there is no ſuch intimate union of ſubſtance; the optic nerve of the affected ſide only being waſted, while the other was large and plump. And the ſame obſervations are contradictory to the doctrine of a decuſſation of all the nerves (§ 8.); for the diſeaſe could be traced from the affected eye to the origin of the nerve on the ſame ſide. In many fiſhes indeed, the doctrine of decuſſation is favoured; for their optic nerves plainly croſs each other, without any union at the part where they are joined in men and moſt quadrupeds.

Theſe people whoſe optic nerves were not joined, having neither ſeen objects double, nor turned their eyes different ways, is alſo a plain proof, that the conjunction of the optic nerves will not ſerve to account for either the uniform motions of our eyes, or our ſeeing objects ſingle with two eyes, though it may be one cauſe of the remarkable ſympathy of the one eye with the other in many diſeaſes.

The *retina* of a recent eye, without any preparation, appears a very fine web, with ſome blood-veſſels coming from its center to be diſtributed on it; but, after a good injection of the arteries that run in the ſubſtance of this nerve, as is common to other nerves, it is with difficulty that we can obſerve its nervous medullary ſubſtance.——The ſituation of theſe veſſels in the central part of the optic nerve the want of medullary fibres here, and the firmneſs of this nerve before it is expanded at its entry into the ball of the eye, may be the reaſon why we do not ſee ſuch bodies, or parts of bodies, whoſe picture falls on this central part of the *retina*.——An inflammation in thoſe arteries of the *retina*, which ſeveral fevers and an *ophthalmia* are generally attended with, may very well account for the tenderneſs in the eyes, and inability to bear the light, which people have in theſe diſeaſes.——The over-diſtenſion of theſe veſſels may likewiſe ſerve to account for the black ſpots obſerved on bright coloured bodies eſpecially, and for that ſmoaky fog through which all objects are ſeen by people in ſome fevers.——If theſe veſſels loſe their tone, and remain preternaturally diſtended, no objects affect our *retina*, though the eye externally appears ſound; or this may be one cauſe of an *amauroſis* or *gutta ſerena*.——From a partial diſtenſion of theſe veſſels, or *paralyſis* of a part of the *retina*, the central part, or the circumference, or any other part of objects, may be loſt to one or both eyes.

The *THIRD PAIR* riſe from the anterior part of the *proceſſus annularis*, and piercing the *dura mater* a little before, and to a ſide of the ends of the poſterior clinoid proceſs of the ſphenoid bone, run along the *receptacula*, or *cavernous ſinuſes*, at the ſide of the *ephippium*, to get out at the *foramina lacera*; after which each of them divides into branches, of which one, after forming a little *ganglion*, is diſtributed to the globe of the eye; the others are ſent to the *muſculus rectus* of the *palpebra*, and to the *attollens*, *adductor*, *deprimens*, and *obliquus minor* muſcles of the eye-ball. Theſe muſcles being principal inſtruments in the motions of the eye-lid and eye-ball, this nerve has therefore got the name of the *motor oculi*.——I have frequently obſerved in convulſions the eye-lids widely opened, the *cornea* turned upward and outwards, and the eye-balls ſunk in the orbit; which well deſcribed the conjunct action of the muſcles which this pair of nerves ſerves.——The diſtenſion of a conſiderable branch of the carotid, which paſſes over this nerve near its origin on each ſide, may poſſibly be the reaſon of the heavineſs in the eye-lids and eyes, after drinking hard, or eating much.

The *FOURTH PAIR*, which are the ſmalleſt nerves of any, derive their origin from the back-part of the baſe of the *teſtes*; and then making a long courſe on the ſide of the annular protuberance, enter the *dura mater* a little farther back, and more externally than the third part, to run alſo along the *receptacula*, to paſs out at the *foramina lacera*, and to be entirely ſpent on the *muſculi trochleares*, or ſuperior oblique muſcles of the eyes. Theſe muſcles being employed in performing the rotatory motions, and the advancement of the eye balls forward, by which ſeveral of our paſſions are expreſſed, the nerves that ſerve them have got the name of *PATHETICI*.——Why theſe ſmall nerves ſhould be brought ſo far to this muſcle, when it could have been ſupplied eaſily by the *motor oculi*, I know not.

The *FIFTH PAIR* are large nerves, riſing from the annular proceſſes where the medullary proceſſes of the *cerebellum* join in the formation of that *tuber*, to enter the *dura mater* near the point of the petrous proceſs of the temporal bones; and then ſinking cloſe by the *receptacula* at the ſides of the *ſella*

ſella turcia, each becomes in appearance thicker, and goes out of the ſcull in three great branches.

The firſt branch of the fifth is the *OPHTHALMIC,* which runs through the *foramen lacerum* to the orbit, having in its paſſage thither a connection with the ſixth pair. It is afterwards diſtributed to the ball of the eye with the third; to the noſe, along with the olfactory, which the branch of the fifth that paſſes through the *foramen orbitarium internum* joins, as was already mentioned in the deſcription of the firſt pair. This ophthalmic branch likewiſe ſupplies the parts at the internal *canthus* of the orbit, the *glandula lacrymalis,* fat, membranes, muſcles, and teguments of the eye-lids; its longeſt fartheſt extended branch paſſing through the *foramen ſuperciliare* of the *os frontis,* to be diſtributed to the fore-head.

The ſmall fibres which this firſt branch of the fifth and the third pair of nerves ſend to the eye ball, being ſituated on the optic nerve, and, after piercing the ſclerotic coat, running along the choroid coat on the outſide of the *retina* in their courſe to the *uvea* or *iris,* may be a cauſe of the ſympathy between the optic nerve and the *uvea;* by which we more readily acquire the habit of contracting the *iris,* and thereby leſſen the pupil, when too ſtrong light is excluded; and, on the contrary, enlarge the pupil, when the light is too faint.—— This, with the ſympathy which muſt ariſe from ſome of the nerves of the membrane of the noſtrils, being derived from this firſt branch of the fifth pair of nerves, may alſo be the cauſe, why an irritation of the *retina*, by too ſtrong light, may produce ſneezing, as if a *ſtimulus* had been applied to the membrane of the noſe itſelf;——why preſſing the internal *canthus* of the orbit, ſometimes ſtops ſneezing;——why irritation of the noſe or of the eye cauſes the eye lids to ſhut convulſively, and makes the tears to flow plentifully; and why medicines put into the noſe, do often great ſervice in diſeaſes of the eyes.—In the megrim all the branches of the nerve diſcover themſelves to be affected: for the forehead is racked with pain, the eye ball is pained, and feels as if it was ſqueezed, the eye-lids ſhut convulſively, the tears trickle down, and an uneaſy heat is felt in the noſe. Hence we can underſtand where external medicines will have the beſt effect, when applied to remove this diſeaſe, to wit, to the membrane of the noſe, and to the forehead;——why alternate preſſure near the ſuperciliary hole of the frontal bone, or ſneezing, ſometimes gives immediate relief in the megrim;——why the ſight may be loſt by an injury done to the *ſupra-orbitar* branch;——how it may be reſtored by agitation of that branch of this nerve.

The ſecond branch of the fifth pair of nerves may be called *MAXILLARIS SUPERIOR*, from its ſerving principally the parts of the upper jaw. It goes out at the round hole of the ſphenoid bone, and ſends immediately one branch into the channel on the top of the *antrum maxillare*; the membrane of which and the upper teeth are ſupplied by it in its paſſage. As this branch is about to go out at the *foramen orbitarium externum*, it ſends a nerve through the ſubſtance of the *os maxillare* to come out at *Steno's* duct, to be diſtributed to the fore-part of the palate; and what remains of it eſcaping at the *external orbitar* hole, divides into a great many branches, that ſupply the cheek, upper lip, and noſtril.—The next conſiderable branch of the *ſuperior maxillary* nerve, after giving branches which are reflected through the ſixth hole of the *ſphenoid* bone, to join the intercoſtal where it is paſſing through the ſcull with the carotid artery, and the *portio dura* of the ſeventh pair, as it paſſes through the *os petroſum*, is ſent into the noſe by the hole common to the palate and ſphenoidal bone; and the remaining part of this nerve runs in the *palato-maxillaris* canal, giving off branches to the temples and pterygoid muſcles, and comes at laſt into the palate to be loſt.——Hence, the ach in the teeth of the upper jaw occaſions a gnawing pain deep ſeated in the bones of the face, with ſwelling in the eye-lids, cheek, noſe, and upper lip; and on the other hand, an inflammation in theſe parts, or a megrim, is often attended with ſharp pain in the teeth.—Hence, an obſtruction in the duct of the maxillary ſinus, which obliges the liquor ſecreted there to find out a preternatural route for itſelf, may be occaſioned by the pain of the teeth. —Hence, the upper lip often ſuffers when the palate or noſe is ulcerated.

The third or *MAXILLARIS INFERIOR* branch of the fifth pair going out at the oval hole of the ſphenoid bone, ſerves the muſcles of the lower jaw, and the muſcles ſituated between the *os hyoides* and *jaw*: All the ſalivary glands, the *amygdalæ*, and the external ear, have branches from it: It has a large branch loſt in the tongue, and ſends another through the canal in the ſubſtance of the lower jaw to ſerve all the teeth there, and to come out at the hole in the fore-part of the jaw, to be loſt in the chin and under lip.———Hence a convulſive contraction of the muſcles of the lower jaw, or the mouth's being involuntarily ſhut, a great flow of ſpittle or ſalivation, a pain in the ear, eſpecially in deglutition, and a ſwelling all about the throat, are natural conſequences of a violent irritation of the nerves of the lower teeth in the toothach; and pain in the teeth and ear, is as natural a conſequence of an *angina.*——Hence alternate preſſure on the chin may ſometimes relieve the violence of a toothach.——Hence deſtroying the nerves of a tooth by actual or potential cauteries, or pulling a carious tooth, ſo often removes immediately all theſe ſymptoms.——Hence no cure is to be found for ſome ulcers in the upper or lower jaw, but by drawing a tooth——Hence in cancers of the upper lip, the ſalivary glands are in danger of being affected, or the diſeaſe may be occaſioned to the lip by its beginning in the glands.——Perhaps the ſympathy of the organs of taſting and ſmelling may in ſome meaſure depend on their both receiving nerves from the fith pair.

The *SIXTH PAIR*, which is the ſmalleſt except the fourth, riſes from the fore-part of the *corpora pyramidalia* ; and each entering the *dura mater* ſome way behind the poſterior clinoid proceſs of the ſphenoid bone, has a long courſe below that-membrane, and within the *receptaculum* at the ſide of the *ſella turcica*, where it is immerſed in the blood of the receptacle; but for what purpoſe I am ignorant. It goes afterwards out at the *foramen lacerum* into the orbit, to ſerve the abductor muſcle of the eye.——A defect in this nerve may therefore be one cauſe of a *ſtrabiſmus*.—In the paſſage of this nerve below the *dura mater*, it lies very contiguous to the internal carotid artery, and to the ophthalmic branch of the fifth pair of nerves. At the place where the ſixth pair is contiguous to the carotid, a nerve either goes from each of them in an uncommon way, to wit, with the angle beyond where it riſes obtuſe, to deſcend with the artery, and to form the beginning of the intercoſtal nerve, according to the common deſcription; or, according to other authors, this nerve comes up from the great *ganglion* of the *intercoſtal*, to be joined to the ſixth here.

The arguments for this latter opinion are, That, according to the common doctrine, this beginning of the *intercoſtal* nerve, as it is called, would riſe in a manner not ſo ordinary in nerves. In the next place, it is obſerved, that the ſixth pair is larger nearer to the orbit, than it is before it comes to the place where this nerve is ſaid to go off; and therefore it is more probable, that it receives an addition there, rather than gives off a branch. *Laſtly*, It is found, that upon cutting the *intercoſtal* nerves of living animals, the eyes plainly were affected; they loſt their bright water; the gum, or gore, as we call it, was ſeparated in greater quantity; the pupil was more contracted; the cartilaginous membrane, at the internal *canthus*, came more over the eye; and the eye-ball itſelf was diminiſhed.

To this it is anſwered, in defence of the more common doctrine, *1ſt*, That other branches of nerves go off in a reflected way, as well as this does, ſuppoſing it to be the beginning of the intercoſtal; and that the reflection would rather be greater, if it is thought to come up from the intercoſtal to the ſixth. *2dly*, It is denied that this nerve is for ordinary thicker at its fore than its back-part; and if it was ſuppoſed to be thickeſt nearer to the orbit, the concluſion made above could not be drawn from this appearance, becauſe other nerves enlarge ſometimes where there is no addition made to them, as in the inſtance already mentioned of the trunk of the fifth pair while below the *dura mater*. *3dly*, The experiments on living animals ſhew indeed, that the eyes are affected upon cutting the intercoſtal nerve, but not in the way which might have been expected, if the *intercoſtal* had furniſhed ſuch a ſhare of the nerve that goes to the *abductor* muſcle of the eye; for it might have been thought, that this muſcle would have been ſo much weakened immediately upon cutting the *inter-*

intercoſtal, that its antagoniſt the *adductor* would have preatly prevailed over it, and have turned the eye ſtrongly in towards the noſe; which is not ſaid to be a conſequence of this experiment. So that the arguments are ſtill equivocal; and more obſervations and experiments muſt be made, before it can be determined with certainty, whether the ſixth pair gives or receives a branch here. In the mean time, I ſhall continue to ſpeak about the origin of the *intercoſtal* with the generality of anatomiſts.

At this place where the intercoſtal begins, the fifth pair is contiguous and adherent to the ſixth; and it is generally ſaid, that the ophthalmic branch of the fifth gives a branch or two to the beginning of the intercoſtal, or receives ſuch from it. Others deny any ſuch communication between them; and thoſe who affirm the communication confeſs, that in ſome ſubjects they could not ſee it. After examining the nerves here in a great many ſubjects, I cannot determine whether or not there are nervous filaments going from the one to the other. Sometimes I have thought that I traced them evidently; at other times I obſerved that what I diſſected for nervous filaments, was collapſed cellular ſubſtance; and in all the ſubjects where I had puſhed an injection ſucceſsfully into the very ſmall arteries, I could only obſerve a *plexus* of veſſels connecting the one to the other. In any of theſe ways, however, there is as much connection as, we are aſſured from many experiments and obſervations on other nerves, is ſufficient to make a very great ſympathy among the nerv here.—Poſſibly the appearances in the eyes dogs, whoſe intercoſtal nerves were cut, mig be owing to this ſympathy.

The *SEVENTH PAIR* comes out fro the lateral part of the *annular proceſs*, behi where the medullary proceſs of the *cerebelli* are joined to that *tuber*; and each being a companied with a larger artery than moſt oth nerves, enters the *internal meatus auditori* where the two large bundles of fibres, of whi it appeared to conſiſt within the ſcull, ſoon parate from each other; one of them enteri by ſeveral ſmall holes into the *veſtible*, *coc lea*, and *ſemicircular canals*, is ſtretched this inner *camera* of the ear in a very ſo pulpy ſubſtance; and being never ſeen in t form of a firm cord, ſuch as the other pa cel of this and moſt other nerves become, called *PORTIO MOLLIS* of the audito nerve.

The other part of this ſeventh pair paſ through *Galen's foramen cæcum*, or *Follopiu aquæduct*, in its crooked paſſage by the ſi of the *tympanum*; in which paſſage, a ner ſent from the lingual branch of the inferi maxillary nerve, along the outſide of t *tuba Euſtachiana*, and croſs the cavity of t *tympanum*, where it has the name of *chor tympani*, is commonly ſaid to be joined to The very acute angle which this nerve mak with the fifth, or the ſudden violent reflecti it would ſuffer on the ſuppoſition of its comi from the fifth to the ſeventh, appears unuſua whereas, if we ſuppoſe that it comes from t

ſeven

venth to the fifth, its courſe would be more
the ordinary way, and the *chorda tympani*
ould be eſteemed a branch of the ſeventh pair
ing 'to join the fifth, the ſize of which is in-
eaſed by this acquiſition. This ſmaller bundle
f the ſeventh gives branches to the muſcles of
e *malleus*, and to the *dura mater*, while it
aſſes through the bony crooked canal, and at
ſt comes out in a firm chord named *POR-*
IO DURA, at the end of this canal, be-
ween the *ſtyloid* and *maſtoid* proceſſes of the
mporal bone, giving immediately filaments
the little oblique muſcles of the head and
thoſe that riſe from the ſtyloid proceſs. It
en pierces through the parotid gland, and
vides into a great many branches, which are
ſperſed in the muſcles and teguments that
over all the ſide of the upper part of the
eck, the whole face and *cranium*, as far back
s the temples, including a conſiderable part
f the external ear. Its branches having thus
conſiderable connection with all the three
anches of the fifth pair, and with the ſecond
ervical, occaſion a conſiderable ſympathy of
eſe nerves with it.—Hence, in the tooth-
h, the pain is ſometimes very little in the
fected tooth, compared to what it is all along
e ſide of the head and in the ear.——Hence
robably the relief of the toothach from
liſters applied behind or before the ear, or by
hot iron touching the *antihelix* of the ear.
—By this communication or connection poſ-
bly too it is, that a vibrating ſtring held be-
ween one's teeth, gives a ſtrong idea of
ound to the perſon who holds it, which no
body

body elſe can perceive.-------Perhaps too th diſtribution of this nerve occaſions the hea to be ſo quickly turned upon the impreſſion o ſound on our ears.

The *EIGHTH PAIR* of nerves riſe fro the lateral baſes of the *corpora olivaria* in diſ gregated fibres ; and as they are entering th anterior internal part of the holes common t the *os occipitis* and *temporum*, each is joine by a nerve which aſcends within the *dura mater* from the tenth of the head, the firſt, ſecond and inferior cervical nerves: This every bod knows has the name of the *NERVUS ACCESSORIUS.* When the two get out o the ſcull the *acceſſorius* ſeparates from th eighth, and, deſcending obliquely outwards, paſſes through the *ſterno-maſtoideus* muſcle, to which it gives branches, and afterwards terminates in the *trapezius* and *rhomboid* muſcles of the *ſcapula*. In this courſe it is generally more or leſs joined by the ſecond cervical nerve.---------Why this nerve, and ſeveral others which are diſtributed to muſcles, are made to pierce through muſcles, which they might have only paſſed near to, I do not know.

The large *eighth pair*, ſoon after its exit, gives nerves to the tongue, *larynx*, *pharynx*, and *ganglion* of the *intercoſtal* nerve, and being disjoined from the ninth and intercoſtal, to which it adheres cloſely ſome way, runs ſtreight down the neck behind the internal jugular vein, and at the external ſide of the carotid artery. As it is about to enter the *thorax*, a large nerve goes off from the eighth of each ſide: This branch of the right-ſide turns round from the fore to the back part of the ſubclavian artery, while the branch of the left-ſide turns round the great curve of the *aorta*, and both of them mounting up again at the ſide of the *œſophagus*, to which they give branches, are loſt at laſt in the *larynx*. Theſe are called the *RECURRENT* nerves, which we are deſired to ſhun in the operation of *bronchotomy*, though their deep ſituation protects them ſufficiently.-----The muſcles of the *larynx* being in a good meaſure ſupplied with nerves from the recurrents, it is to be expected, that the cutting of them will greatly weaken the voice, though it will not be entirely loſt, ſo long as the ſuperior branches of the eighth pair are entire.——Why the recurrent nerves riſe ſo low from the eighth pair to go round a large artery, and to have ſuch a long courſe upwards, I know not.

The eighth pair, above and at or near the place where the recurrent nerves go off from it, or frequently the recurrents themſelves, ſend off ſmall nerves to the *pericardium*, and to join with the branches of the intercoſtal that are diſtributed to the heart; but their ſize and ſituation are uncertain.

After theſe branches are ſent off, the *par vagum* on each ſide deſcends behind the great branch of the *trachea*, and gives numerous filaments to the lungs, and ſome to the heart in going to the *œſophagus*. The one of the left-ſide running on the fore-part of the *œſophagus*, communicates by ſeveral branches with the right one in its deſcent to be diſtributed to the ſtomach: The right one gets behind the *œſophagus*, where it ſplits and rejoins ſeveral times before it arrives at the ſtomach, to which it ſends nerves; and then being joined by one or more branches from the left-trunk, they run towards the cæliac artery, there to join into the great *ſemilunar ganglion* formed by the two intercoſtals.

From the diſtribution of this *par vagum*, we may learn how tickling the *fauces* with a feather or any ſuch ſubſtance, excites a *nauſea* and inclination to vomit; - - - - -why coughing occaſions vomiting, or vomiting raiſes a cough. ——— Hence we ſee how the nervous *aſthma* and the *tuſſis convulſiva*, chincough, are attended with a ſtraitening of the *glottis*;—why food difficult to digeſt occaſions the *aſthma* to weakly people; and why *emetics* have frequently cured the *aſthma* very ſpeedily;——— why an attempt to vomit is ſometimes in danger of ſuffocating *aſthmatic* people;---why the ſuperior orifice of the ſtomach is ſo ſenſible, as to be looked on as the ſeat of the ſoul by ſome; - - - - why people ſubject to diſtenſions of the ſtomach, have ſo often the ſenſation of balls in their breaſts and throats;———why the *globus hyſtericus* is ſo often attended with a violent ſtrangulation at the *glottis*.

The *NINTH PAIR* of nerves comes from the inferior part of the *corpora pyramidalia*, to go out of the ſcull at their proper holes of the occipital bone. After their egreſs they adhere for ſome way firmly to the eighth and intercoſtal; and then ſending a branch, that in many ſubjects is joined with branches of the firſt and ſecond cervical nerves, to be diſtributed to the thyroid gland and muſcles on the fore-part of the *trachea arteria*, the ninth is loſt in the muſcles and ſubſtance of the tongue. Some have thought this nerve, and others have eſteemed the third branch of the fifth pair of nerves, to be the proper guſtatory nerve. I know no obſervation or experiments to prove either opinion, or to aſſure us, that both nerves do not ſerve for taſting and for the motion of the tongue.——May not the diſtribution of this nerve to the muſcles below, as well as above the *os hyoides*, contribute to their acting more uniformly in depreſſing the lower jaw or head?

The *TENTH PAIR* riſes in ſeparate threads from the ſides of the *ſpinal marrow*, to go out between the *os occipitis* and *firſt vertebra* of the neck. After each of them has given branches to the great ganglion of the intercoſtal, 8th, 9th, and 1ſt cervical nerves, it is diſtributed to the ſtreight, oblique, and ſome of the extenſor muſcles of the head. Whether the name of the tenth of the head, or of the firſt vertebral, ought to be given to this pair of nerves, is of no ſuch conſequence as to deſerve a debate, tho' it has ſome of the marks of the ſpinal nerves, to wit, its being formed of filaments proceeding from both the fore and back part of the *medulla*, and a little *ganglion* being formed where theſe filaments meet.

In the deſcription of the ſixth pair, I followed the uſual way of ſpeaking among anatomiſts, and called that the beginning of the in-buted to the ſtomach: The right one gets behind the *œſophagus*, where it ſplits and rejoins ſeveral times before it arrives at the ſtomach, to which it ſends nerves; and then being joined by one or more branches from the left-trunk, they run towards the cæliac artery, there to join into the great *ſemilunar ganglion* formed by the two intercoſtals.

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The *TENTH PAIR* riſes in ſeparate threads from the ſides of the *ſpinal marrow*, to go out between the *os occipitis* and *firſt vertebra* of the neck. After each of them has given branches to the great ganglion of the intercoſtal, 8th, 9th, and 1ſt cervical nerves, it is diſtributed to the ſtreight, oblique, and ſome of the extenſor muſcles of the head. Whether the name of the tenth of the head, or of the firſt vertebral, ought to be given to this pair of nerves, is of no ſuch conſequence as to deſerve a debate, tho' it has ſome of the marks of the ſpinal nerves, to wit, its being formed of filaments proceeding from both the fore and back part of the *medulla*, and a little *ganglion* being formed where theſe filaments meet.

In the deſcription of the ſixth pair, I followed the uſual way of ſpeaking among anatomiſts, and called that the beginning of the intercoſtal nerve which comes out of the ſcull; and therefore ſhall here ſubjoin a curſory deſcription of this nerve, notwithſtanding its much larger part is compoſed of nerves coming out from the *ſpinal marrow.* There is no greater incongruity in point of method to ſay, that the nerve we are deſcribing receives additions from others that have not been deſcribed, than it is to repeat in the deſcription of a great many nerves, that each of them gives branches to form a nerve which we are ignorant of; which is all the difference between deſcribing the intercoſtal before or after the ſpinal nerves.

The branch reflected from the ſixth pair, joined poſſibly by ſome filaments of the *opththalmic* branch of the fifth, runs along with the internal carotid artery, through the crooked canal formed for it in the *temporal bone,* where the little nerve is very ſoft and pappy, and in ſeveral ſubjects divides and unites again, and is joined by one or more branches from the fifth, particularly of its ſuperior maxillary branch, before it comes out of the ſcull. May the compreſſion of this nerve by the carotid artery when ſtretched during the *ſyſtole,* contribute to the *diaſtole* of the heart? As ſoon as the nerve eſcapes out of this bony canal, it is connected a little way with the eighth and ninth; then ſeparating from theſe, after ſeeming to receive additional nerves from them, it forms a large *ganglion,* into which branches from the tenth of the head, and from the firſt and ſecond cervical, enter. From this ganglion the nerves come out again ſmall to run down the neck along with the carotid artery, communicating by branches with the cervical nerves, and giving nerves to the muſcles that bend the head and neck. As the *intercoſtal* is about to enter the *thorax*, it forms another ganglion, from which nerves are ſent to the *trachea* and to the heart; theſe deſigned for the heart joining with the branches of the eighth, and moſt of them paſſing between the two great arteries and the auricles, to the ſubſtance of that muſcle. The intercoſtal after this conſiſting of two branches, one going behind, and the other running over the fore-part of the ſubclavian artery, forms a new ganglion where the two branches unite below that artery, and then deſcending along the ſides of the *vertebrae* of the *thorax*, receives branches from each of the dorſal nerves; which branches appearing to come out between the ribs, have given the name of intercoſtal to the whole nerve. Where the addition is made to it from the fifth dorſal nerve, a branch goes off obliquely forewards; which being joined by ſuch branches from the ſixth, ſeventh, eighth, and ninth dorſal, an anterior trunk is formed; and paſſes between the fibres of the *appendix muſculoſa* of the diaphragm, to form, along with the other intercoſtal and the branches of the eighth pair, a large ſemilunar ganglion, ſituated between the cæliac and ſuperior meſenteric arteries; the roots of which are as it were involved in a ſort of nervous net-work of this ganglion, from which a great number of very ſmall nervous threads run out to be extended on the ſurface of all the branches of thoſe two arteries, ſo as to be eaſily ſeen when any of the arteries are ſtretched, but not to be raiſed from them by diſſection; and thus the *liver*, *gall-bladder*, *duodenum*, *pancreas*, *ſpleen*, *jejunum*, *ilium*, and a large ſhare of the *colon*, have their nerves ſent from this great *ſolar ganglion* or *plexus*.——May the periſtaltic motion of the inteſtines depend in ſome meaſure on the paſſage of the intercoſtal nerves through the diaphragm?

Several fibres of this ganglion, running down upon the *aorta*, meet with other nerves ſent from the poſterior trunk of the intercoſtal, which continues its courſe along the ſides of the *vertebræ*, they ſupply the *glandulae renales*, kidneys, and *teſtes* in men, or *ovaria* in women; and then they form a network upon the inferior meſenteric artery where the nerves of the two ſides meet, and accompany the branches of this artery to the part of the *colon* that lies in the left ſide of the belly, and to the *rectum*, as far down as to the lower part of the *pelvis*.

The intercoſtal continuing down by the ſide of the *vertebræ* of the loins, is joined by nerves coming from between theſe *vertebræ*, and ſends nerves to the organs of generation and others in the *pelvis*, being even joined with thoſe that are ſent to the inferior extremities.

The almoſt univerſal connection and communication which this nerve has with the other nerves of the body, may lead us to underſtand the following, and a great many more *phænomena*:—Why tickling the noſe cauſes ſneezing.——Why the too great quantity of bile in the *cholera* occaſions vomiting as well as purging,

purging——Why people vomit in colics, in inflammations, or other irritations of the liver, or of the ducts going from it and the gall bladder.——Why a ſtone in the kidneys, or ureters, or any other cauſe irritating thoſe organs, ſhould ſo much more frequently bring on vomiting and other diſorders of the ſtomach, than the ſtone, or any other ſtimulating cauſe in the bladder does.——Why vomiting is a ſymptom of danger after child-birth, lithotomy, and other operations on the parts in the *pelvis*.——Why the obſtructions of the *menſes* are capable of occaſioning ſtrangulations, belching, colics, ſtomach-aches, and even convulſions in the extremities.——Why veſicatories, applied from the ears to the clavicles of children labouring under the *tuſſis convulſiva*, are frequently of great ſervice.—Why worms in the ſtomach or guts excite an itching in the noſe, or grinding of the teeth.—Why irritations in the bowels or the belly occaſion ſometimes univerſal convulſions of the body.

The *ſpinal* nerves riſe generally by a number of diſgregated fibres from both the fore and back part of the *medulla ſpinalis*, and ſoon after form a little knot or ganglion, where they acquire ſtrong coats, and are extended into firm cords. They are diſtinguiſhed by numbers, according to the *vertebræ* from between which they come out; the ſuperior of the two bones forming the hole through which they paſs, being the one from which the number is applied to each nerve. There are generally ſaid to be *thirty pair* of them; ſeven of which come out between the *vertebræ*

vertebræ of the *neck*, twelve between thoſe of the *back*, five between thoſe of the loins, and ſix from the *falſe vertebræ*.

The *FIRST CERVICAL* pair of nerves comes out between the firſt and ſecond *vertebræ* of the neck; and having given branches to join with the tenth pair of the head, the ſecond cervical and intercoſtal, and to ſerve the muſcles that bend the neck, it ſends its largeſt branches backwards to the extenſor muſcles of the head and neck; ſome of which piercing through theſe muſcles, run up on the *occiput* to be loſt in the teguments here; and many fibres of it advance ſo far foreward as to be connected with the *fibrils* of the firſt branch of the fifth pair of the head, and of the *portio dura* of the *auditory nerve*.—— Hence poſſibly it is that a *clavus hyſtericus* changes ſuddenly ſometimes from the forehead to a violent pain and ſpaſm in the back-part of the head and neck.

The *SECOND CERVICAL* is ſoon joined by ſome branches to the ninth of the head and intercoſtal, and to the firſt and third of the neck; then has a large branch that comes out at the exterior edge of the *ſterno-maſtoideus* muſcle, where it joins with the *acceſſorius* of the eighth pair; and is afterwards diſtributed to the *platyſma myoides*, teguments of the ſide of the neck and head, parotid gland, and external ear, being connected to the *portio dura* of the auditory nerve, and to the firſt cervical. The remainder of this ſecond cervical is ſpent on the *levator ſcapulæ* and the extenſors of the neck and head. Generally a large branch is here ſent off to join the *acceſſorius* of the eighth pair, near the ſuperior angle of the *ſcapula*.

To the irritation of the branches of this nerve it probably is, that, in an inflammation of the parotid gland, the neck is pained ſo far down as the clavicle, the head is drawn towards the ſhoulder of the affected ſide, and the chin is turned to the other ſide.——In opening the external jugular vein, no operator can promiſe not to touch ſome of the cutaneous branches of this nerve with the lancet; which occaſions a ſharp pricking pain in the mean time, and a numbneſs of the ſkin near the orifice for ſome time after.

The *THIRD PAIR* of the neck paſſes out between the third and fourth cervical *vertebræ*; having immediately a communication with the ſecond, and ſending down a branch, which being joined by a branch from the fourth cervical, forms the *PHRENIC* nerve. This deſcending enters the *thorax* between the ſubclavian vein and artery; and then being received into a groove formed for it in the *pericardium*, it has its courſe along this *capſula* of the heart, till it is loſt in the middle part of the diaphragm. The right phrenic has a ſtreight courſe; but the left one is obliged to make a conſiderable turn outwards to go over the prominent part of the *pericardium*, where the point of the heart is lodged. Hence in violent palpitations of the heart, a pungent acute pain is felt near the left orifice of the ſtomach.——The middle of the diaphragm ſcarce could have been ſupplied by any other nerve which could have had ſuch a ſtreight courſe as the *phrenic* has. If the ſubclavian artery and vein have any effect upon this nerve, I do not know it.

The other branches of the third cervical nerve are diſtributed to the muſcles and teguments at the lower part of the neck and top of the ſhoulder. No wonder then that an inflammation of the liver or ſpleen, an abſceſs in the longs adhering to the diaphragm, or any other cauſe capable of irritating the diaphragm, ſhould be attended with a ſharp pain on the top of the ſhoulder, as well as wounds, ulcers, *&c.* of this muſcle itſelf—If the irritation of this muſcle is very violent, it may occaſion that convulſive contraction of the diaphragm which is called an *hiccough*; and therefore an hiccough in an inflammation of the liver has been juſtly declared to be an ill ſymptom.

An irritation of the thoracic nerves which produces ſneezing, may ſometimes free the phrenic nerves from any ſpaſm they occaſion; ſo that ſneezing ſometimes takes away the hiccough; and a derivation of the fluid of the nerves any other way may do the ſame thing: Or the hiccough may alſo be ſometimes cured, by drawing up into the noſe the ſmoak of burning paper or other acrid fumes, ſwallowing pungent or aromatic medicines, and by a ſurprize, or any other ſtrong application of the mind in thinking, or in diſtinguiſhing objects: Or, when all theſe have failed, it has been put away by the briſk *ſtimulus* of a bliſtering plaiſter applied to the back.

The *FOURTH CERVICAL* nerve, after ſending off that branch which joins with the third to form the phrenic, and beſtowing twigs on the muſcles and glands of the neck, runs to the arm-pit, where it meets with the *FIFTH, SIXTH,* and *SEVENTH* cervicals, and *FIRST DORSAL*, that eſcape in the interſtices of the *muſculi ſcaleni*, to come at the arm-pit, where they join, ſeparate, and rejoin, in a way ſcarce to be rightly expreſſed in words; and, after giving ſeveral conſiderable nerves to the muſcles and teguments which cover the *thorax*, they divide into ſeveral branches, to be diſtributed to all the parts of the ſuperior extremity. Seven of theſe branches I ſhall deſcribe under particular names.

1. *SCAPULARIS* runs ſtreight to the *cavitas ſemilunata* of the upper *coſta* of the *ſcapula*, which is a hole in the recent ſubject by a ligament being extended from one angle of the bone to the other, giving nerves in its way to the muſcles of the *ſcapula*. When it has paſſed this hole, it ſupplies the *ſupra ſpinatus* muſcle; and then deſcending at the anterior root of the *ſpine* of the *ſcapula*, it is loſt in the other muſcles that lie on the *dorſum* of that bone.

2. *ARTICULARIS* ſinks downwards at the *axilla*, to get below the neck of the head of the *os humeri*, and to mount again at the back-part of it; ſo that it almoſt ſurrounds the articulation, and is diſtributed to the muſcles that draw the arm back, and to thoſe that raiſe it up.

3. *CUTANEUS* runs down the fore-part of the arm near the ſkin, to which it gives off branches; and then divides on the inſide of the fore-arm into ſeveral nerves, which ſupply the teguments there, and on the palm of the hand.------In opening the baſilic vein of the arm, at the ordinary place, the ſame ſymptoms are ſometimes produced as in opening the external jugular vein, and from a like cauſe, to wit, from hurting a branch of this cutaneous nerve with the lancet.

4. *MUSCULO-CUTANEUS*, or *perforans Caſſeri*, paſſes through the *coracobrachialis* muſcle; and, after ſupplying the *biceps flexor cubiti* and *brachiœus internus*, paſſes behind the tendon of the *biceps*, and over the cephalic vein, to be beſtowed on the teguments on the outſide of the fore-arm and back of the hand.------This nerve is ſometimes hurt in opening the cephalic vein, and cauſes pain and numbneſs for a ſhort time.

5. *MUSCULARIS* has a ſpiral courſe from the *axilla*, under the *os humeri*, and backward to the external part of that bone, ſupplying by the way the extenſor muſcles of the fore-arm, to which it runs between the two *brachiœi* muſcles, and within the *ſupinator radii longus*.——At the upper-part of the fore-arm, it ſends off a branch, which accompanies the *ſupinator longus* till it comes near the wriſt, where it paſſes obliquely over the *radius*, to be loſt in the back of the hand and fingers.------The principal part of this nerve pierces through the *ſupinator radii brevis*, to

ſerve the muſcles that extend the hand and fingers, whoſe actions are not injured when the *ſupinator* acts.

6. *ULNARIS* is extended along the inſide of the arm, to give nerves to the muſcles that extend the fore-arm and to the teguments of the elbow: Towards the lower part of the arm, it ſlants a little backward to come at the groove behind the internal condyle of the *os humeri,* through which it runs to the *ulna*: In its courſe along this bone, it ſerves the neighbouring muſcles and teguments; and as it comes near the wriſt, it detaches a branch obliquely over the *ulna* to the back of the hand, to be loſt in the convex part of ſeveral fingers. The larger part of the nerve goes ſtreight foreward to the internal ſide of the *os piſiforme* of the wriſt; where it ſends off a branch which ſinks under the large tendons in the palm, to go croſs to the other ſide of the wriſt, ſerving the *muſculi lumbricales* and *interoſſei,* and at laſt terminating in the ſhort muſcles of the thumb and fore-finger. What remains of the ulnar nerve after ſupplying the ſhort muſcles of the little-finger, divides into three branches; whereof two are extended along the ſides of the ſheath of the tendons of the flexors of the little-finger, to furniſh the concave ſide of that finger; and the third branch is diſpoſed in the ſame way upon the ſide of the ring finger next to the little-finger.

When we lean or preſs on the internal condyle of the *os humeri,* the numbneſs and prickling we frequently feel, point out the courſe of this nerve. I have ſeen a weakneſs and atrophy in the parts which I mentioned this nerve to be ſent to, after a wound in the internal lower part of the arm.

7. *RADIALIS* accompanies the humeral artery to the bending of the elbow, ſerving the flexors of the cubit in its way; then paſſing through the *pronator radii teres* muſcle, it gives nerves to the muſcles on the fore-part of the fore-arm, and continues its courſe near to the *radius*, beſtowing branches on the circumjacent muſcles. Near the wriſt, it ſometimes gives off a nerve which is diſtributed to the back of the hand, and the convex part of the thumb and ſeveral of the fingers, inſtead of the branch of the muſcular. The larger part of this nerve, paſſing behind the annular ligament of the wriſt, gives nerves to the ſhort muſcles of the thumb; and afterwards ſends a branch along each ſide of the ſheath of the tendons of the flexors of the thumb, fore-finger, mid-finger, and one branch to the ſide of the ring-finger, next to the middle one, to be loſt on the concave ſide of thoſe fingers.

Though the *radial* nerve paſſes through the *pronator* muſcle, and the *muſcular* nerve ſeems to be ſtill more unfavourably placed within the *ſupinator brevis*; yet the action of theſe muſcles don't ſeem to have any effect in hindering the influence of theſe nerves, for the fingers or hand can be bended while pronation is performing vigorouſly, and they can be extended while ſupination is exerciſed.

The manner of the going off of theſe nerves of the fingers, both from the *ulnar* and *radial*, is, that a ſingle branch is ſent from the trunk to the ſide of the thumb and little-finger fartheſt from the other fingers; and all the reſt are ſupplied by a trunk of a nerve, which ſplits into two ſome way before it comes as far as the end of the *metacarpus*, to run along the ſides of different fingers that are neareſt to each other.

It might have been obſerved, that, in deſcribing the poſterior branches of the *ulnar* and *muſcular nerve*, I did not mention the particular fingers, to the convex part of which they are diſtributed. My reaſon for this omiſſion is, the uncertainty of their diſtribution; for though ſometimes theſe poſterior branches go to the ſame fingers, to the concave part of which the anterior branches of the *ulnar* and *radial* are ſent, yet frequently they are diſtributed otherwiſe.

The ſituation of theſe brachial nerves in the *axilla*, may let us ſee, how a weakneſs and atrophy may be brought on the arms by long continued preſſure of crutches, or ſuch other hard ſubſtances on this part; and the courſe of them from the neck to the arm may teach us, how much better effects veſicatories, or ſtimulating nervous medicines, would have, when applied to the ſkin, covering the tranſverſe proceſſes of the *vertebræ* of the neck, or at the *axilla*, than when they are put between the ſhoulders, or upon the ſpinal proceſſes, in convulſions or palſies of the ſuperior extremities, where a *ſtimulus* is required.

The *TWELVE DORSAL* nerves of each ſide, as ſoon as they eſcape from between the *vertebræ*, ſend a branch foreward to join the intercoſtal, by which a communication is made among them all; and they ſoon likewiſe give branches backwards to the muſcles that raiſe the trunk of the body, their principal trunk being extended outwards to come at the furrow in the lower edge of each rib, in which they run toward the anterior part of the *thorax*, between the internal and external intercoſtal muſcles, giving off branches in their courſe to the muſcles and teguments of the *thorax*.

The *FIRST* dorſal, as was already obſerved, is particular in this, that it contributes to form the brachial nerves; and that the two branches of the intercoſtal, which come down to the *thorax*, form a conſiderable ganglion with it.

The *SIX* lower dorſal nerves give branches to the diaphragm and abdominal muſcles.

The *TWELFTH* joins with the firſt lumbar, and beſtows nerves on the *muſculus quadratus lumborum* and *iliacus internus*.

May not the communications of all theſe nerves be one reaſon, why the parts they ſerve act ſo uniformly and conjunctly in reſpiration, and conſpire together in the convulſive motions of coughing, ſneezing, *&c.*? ——The twitching ſpaſms that happen ſometimes in different parts of the muſcles of the *abdomen*, by an irritation on the branches of the lower dorſal nerves, are in danger of occaſioning a miſtake in practice, by their reſemblance to the colick, *nephritis*, *&c.*——

The communications of theſe lower ones with the intercoſtals, may ſerve to explain the violent effort of the abdominal muſcles in a *teneſmus* and in child bearing.

As the intercoſtal is larger in the *thorax* than any where elſe, and ſeems to diminiſh gradually as it aſcends and deſcends, there is cauſe to ſuſpect that this is the trunk from which the ſuperior and inferior pairs are ſent as branches.

The *FIVE LUMBAR* nerves on each ſide communicate with the intercoſtal and with each other, and give branches backwards to the loins.

The *FIRST* communicates with the laſt dorſal, ſends branches to the abdominal muſcles, to the *pſoas* and *iliacus*, and to the teguments and muſcles on the fore-part of the thigh; while its principal branch joins with the other nerves, to form the crural nerve.

The *SECOND LUMBAR* nerve paſſes through the *pſoas muſcle*, and is diſtributed nearly in the ſame way as the former: as is alſo the *THIRD*.

Branches of the *ſecond*, *third*, and *fourth*, make up one trunk, which runs along the fore-part of the *pelvis*; and paſſing in the notch at the fore-part of the great hole common to the *os pubis* and *iſchium*, is ſpent on the *adductor* muſcles, and on the teguments on the inſide of the thigh. This nerve is called the *OBTURATOR* or *POSTERIOR CRURAL NERVE*.

By united branches from the *firſt*, *ſecond*, *third*, and *fourth* lumbar nerves, a nerve is formed that runs along the *pſoas* muſcle, to eſcape with the external iliac veſſels out of the *abdomen*, below the tendinous arcade of the external oblique muſcle. This nerve, which is named the *ANTERIOR CRURAL*, is diſtributed principally to the muſcles and teguments on the fore part of the thigh. A branch, however, of this nerve runs down the inſide of the leg to the upper part of the foot, keeping near to the *vena ſaphæna*; in opening of which with a lancet at the ancle, the nerve is ſometimes hurt, and occaſions ſharp pain at the time of the operation, and numbneſs afterwards.

The remainder of the fourth lumbar and the fifth join in compoſing the largeſt nerve of the body; which is ſoon to be deſcribed.

Whoever attends to the courſe of theſe lumbar nerves, and of the ſpermatic veſſels and nerves upon the *pſoas* muſcle, with the oblique paſſage of the *ureter* over that muſcle, will not be ſurpriſed, that when a ſtone is paſſing in this canal, or even when it is inflamed, the trunk of the body cannot be raiſed erect, without great pain; or that the ſkin of the thigh becomes leſs ſenſible, and the thigh is drawn foreward, and that the teſticle often ſwells and is drawn convulſively towards the ring of the abdominal muſcles.

The *SIXTH PAIR* of the falſe *VERTEBRÆ* conſiſt each of ſmall poſterior branches ſent to the hips, and of large anterior branches.

The *firſt*, *ſecond*, and *third*, after coming through the three upper holes in the forepart

part of the *os ſacrum*, join together with the fourth and fifth of the loins, to form the largeſt nerve of the body, which is well known by the name of *SCIATIC* or *ISCHIATIC* nerve: This, after ſending large nerves to the different parts of the *pelvis*, and to the external parts of generation and the *podex*, as alſo to the muſcles of the hips, paſſes behind the great *tuber* of the *os iſchium*, and then over the *quadrigemini* muſcles to run down near to the bone of the thigh at its back-part, giving off nerves to the neighbouring muſcles and teguments. Some way above the ham, where it has the name of the *poplitæus* nerve, it ſends off a large branch that paſſes over the *fibula*, and ſinking in among the muſcles on the anterior external part of the leg, runs down to the foot, to be loſt in the upper part of the larger toes, ſupplying the neighbouring muſcles and teguments every where in its paſſage. The larger branch of the *ſciatic*, after giving branches to the muſcles and teguments about the ham and knee, and ſending a large cutaneous nerve down the calf of the leg, to be loſt at laſt on the outſide of the foot and upper part of the leſſer toes, ſinks below the *gemellus* muſcle, and diſtributes nerves to the muſcles on the back of the leg: among which it continues its courſe, till paſſing behind the internal *malleolus*, and in the internal hollow of the *os calcis*, it divides into the two plantar nerves: The internal of which is diſtributed to the toes in the ſame manner that the *radial* nerve of the hand ſerves the concave ſide of the thumb and fingers; and the external *plan-*

tar is divided and diſtributed to the ſole of the foot and toes, nearly as the *ulnar* nerve is in the palm of the hand, and in the concave part of the fingers.

Several branches of theſe nerves, that ſerve the *inferior extremities*, pierce through muſcles.

By applying what was ſaid of the nerves in general to the particular diſtribution of the nerves of the *inferior extremities*, we may ſee how people with fractured legs, eſpecially where there are ſplinters, ſhould be ſubject to convulſive ſtartings of the fractured member. - - - - Why, upon tying the blood veſſels in an amputation of the leg, the patients ſhould ſometimes complain of violent pain in their toes; - - - - why ſuch patients ſhould alſo be troubled with ſtartings; - - - why, for a conſiderable time after the amputation of the diſeaſed limb, when the ſuppuration is well advanced, they ſhould complain of pain in the ſore which occaſioned the amputation..

The *FOURTH*, which, with the two following, is much ſmaller than the three ſuperior, ſoon is loſt in the *veſica urinaria* and *inteſtinum rectum*.

The *FIFTH* comes foreward between the extremity of the *os ſacrum* and *coccygis*, to be diſtributed principally to the *levatores ani*.

The *SIXTH*, which ſome think to be only a production of the *dura mater*, advances foreward below the broad ſhoulders of the firſt bone of the *os coccygis*, and is loſt in the *ſphincter ani* and teguments covering it.

The branches of the four laſt cervical nerves, and of the firſt dorſal, which are beſtowed on the *ſuperior extremities*, and the two crurals, with the ſciatic, which are diſtributed to the *inferior extremities*, are much larger proportionally to the parts they ſerve, than the nerves of the trunk of the body, and eſpecially of the *viſcera*, are; and for a very good reaſon, that in the moſt common neceſſary actions of life, a ſufficient quantity of fluid, on which the influence of nerves ſeems to depend, may be ſupplied to the muſcles there, which are obliged to perform more frequent and violent contractions than any other parts do. - - - - -The ſize of the nerves of the *inferior extremities* ſeems larger proportionally than in the *ſuperior extremities*; the *inferior extremities* having the weight of the whole body to ſuſtain, and that frequently at a great diſadvantage. - —— What the effect is of the nerves here being injured, we ſee daily, when people happen, by ſitting wrong, to compreſs the ſciatic nerve, they are incapable for ſome time after to ſupport themſelves on the affected *extremity:* And this is ſtill more remarkable in the *ſciatic* or *hip-gout*, in which the member is not only weakened, but gradually ſhrivels and waſtes.

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THE

DESCRIPTION

Of the HUMAN

LACTEAL SAC AND DUCT.

THE *receptaculum chyli* of *Pecquet*, or *ſaccus lacteus* of *Van Horne*, is a membranous ſomewhat pyriform bag, two thirds of an inch long, one third of an inch over in its largeſt part when collapſed; ſituated on the firſt *vertebra* of the loins to the right of the *aorta*, a little higher than the right emulgent artery, behind the right inferior muſcle of the diaphragm: it is formed by the union of three tubes, one from under the *aorta*, the ſecond from the interſtice of the *aorta* and *cava*, the third from under the emulgents of the right ſide. The *lacteal ſac*, becoming gradually ſmaller towards its upper part, is contracted into a ſlender membranous pipe, of about a line diameter, which is generally named the *THORACIC DUCT.* This paſſes betwixt the muſcular *appendices* or inferior muſcles of the diaphragm, on the right of, and ſomewhat behind the *aorta* ; then, being lodged in the cellular ſubſtance behind the *pleura*, it mounts between the *aorta* and the *vena azygos* as far as the fifth *vertebra* of the *thorax*, where it is hid by the *azygos*, as this vein riſes forewards to join the deſcending or ſuperior *cava*; after which the duct paſſes obliquely over to the left ſide behind the *œſophagus*, *aorta deſcendens*, and the great curvature of the *aorta*, until it reaches the left carotid artery ; behind which, on the left ſide of the *œſophagus*, it runs to the interſtice of the firſt and ſecond *vertebra* of the *thorax*, where it begins to ſeparate from the carotid, ſtretching farther towards the left internal jugular vein by a circular turn, whoſe convex part is uppermoſt. At the top of this arch it ſplits into two for a line and an half ; the ſuperior branch receiving into it a large lymphatic veſſel from the cervical glands. This lymphatic appears, by blowing air and injecting liquors into it, to have few valves. When the two branches are again united, the duct continues its courſe towards the internal jugular vein, behind which it deſcends, and, immediately at the left ſide of the inſertion of this vein, enters the ſuperior poſterior part of the left ſubclavian vein, whoſe internal membrane duplicated, forms a ſemilunar valve that is convex externally, and covers two thirds of the orifice of the duct ; immediately below this orifice, a cervical vein from the *muſculi ſcaleni* enters the ſubclavian.

The coats of the *ſac* and *duct* are thin tranſparent membranes; from the inſide of which, in the duct, ſmall ſemilunar valves are produced, moſt commonly in pairs; which are ſo ſituated as to allow the paſſage of liquors upwards, but oppoſe their return in an oppoſite courſe. The number of theſe is generally ten or twelve.

This is the moſt ſimple and common courſe, ſituation, and ſtructure of the *receptaculum chyli* and *thoracic duct*; but having had occaſion to obſerve a variety in theſe parts, of different ſubjects, I ſhall ſet down the moſt remarkable of them.

The ſac is ſometimes ſituated lower down than in the former deſcription; is not always of the ſame dimenſions; is not compoſed of the ſame number of ducts; and frequently appears to conſiſt of ſeveral ſmall cells or ducts, inſtead of being one ſimple cavity.

The diameter of the duct is various in moſt bodies, and is ſeldom uniform in the ſame ſubject; but frequently ſudden enlargements or *ſacculi* of it are obſervable. - - - - - The diviſions which authors mention of this duct are very uncertain. I have ſeen it divided into two, whereof one branch climbed over the forepart of the *aorta* at the eighth *vertebra* of the *thorax*, and at the fifth ſlipped behind that artery, to join the other branch which continued in the ordinary courſe.———The preciſe *vertebra*, where it begins to turn to the left ſide, is alſo uncertain.————Frequently it does not ſplit at its ſuperior arch ; in which caſe a large ſac is found near its aperture into the ſubclavian vein.——Generally it has but one orifice ; though I have ſeen two in one body, and three in another : Nay, ſometimes it divides into two, under the curvature of the great artery ; one goes to the right, another to the left ſubclavian vein ; and I have found this duct diſcharging itſelf entirely into the right ſubclavian.——The lymphatic veſſel which enters its ſuperior arch, is often ſent from the *thyroid* gland.

Whether is not the ſituation of the *receptaculum chyli* ſo much nearer the muſcular *appendices* of the diaphragm in men than in brutes, deſigned to ſupply the diſadvantageous courſe the chyle muſt otherwiſe have in our erect poſture ?

Does not the deſcent of the end of the duct to the ſubclavian vein, and the opening of the lymphatic into the top of the arch, contribute to the ready admiſſion of the chyle into that vein ?

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